Grades 5-8 (AD), 9-12 (AD) Duration: 20-30 min Tools: one Logifaces Set / class Individual work Keywords: Regular prism, Volume	516 - Truncated Volumes **MATHS / 3D GEOMETRY**	LOGIFACES METHODOLOGY Erasmus+ **TEACHER** Logifaces 2019-1-HU01-KA201-0612722019-1

DESCRIPTION

Students calculate the volume of the different Logifaces blocks.

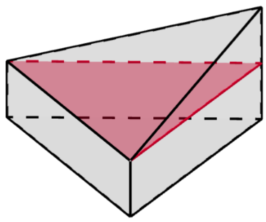
LEVEL 1 Consider the volume of block 112, 113 or 223.

LEVEL 2 Consider the volume of block 122, 133 or 233.

LEVEL 3 Consider the volume of block 123 by cutting it into smaller polyhedra.

SOLUTIONS / EXAMPLES

LEVEL 1 The volume of blocks 112, 113 and 223 can be calculated as follows:



Cut the block into two parts with a plane parallel to the base to obtain a regular prism and a triangular-based pyramid. Calculate the volume of the regular prism and the pyramid separately:

Volume of the regular prism: $V = \frac{a^2\sqrt{3}}{4} \times h.$

Volume of the triangular-based pyramid: $V = \frac{A \times h}{3} = \frac{a^2\sqrt{3}}{4} \times \frac{h}{3}$

<u>block 112:</u>

- regular prism: $V = \frac{4^2\sqrt{3}}{4} \times 1 = 4\sqrt{3}$

- pyramid: $V = \frac{4^2\sqrt{3}}{4} \times 1:3 = \frac{4}{3}\sqrt{3}$

- block 112: $V = 4\sqrt{3} + \frac{4}{3}\sqrt{3} = \frac{16}{3}\sqrt{3} \approx 9.234$

<u>block 113:</u>

- regular prism: $V = \frac{4^2\sqrt{3}}{4} \times 1 = 4\sqrt{3}$

- pyramid: $V = \frac{4^2\sqrt{3}}{4} \times 2:3 = \frac{8}{3}\sqrt{3}$

- block 113: $V = 4\sqrt{3} + \frac{8}{3}\sqrt{3} = \frac{20}{3}\sqrt{3} \approx 11.547$

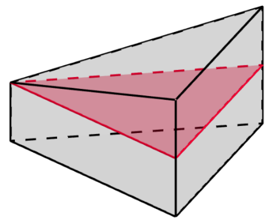
block 223:

- regular prism: $V = \frac{4^2\sqrt{3}}{4} \times 2 = 8\sqrt{3}$

- pyramid: $V = \frac{4^2\sqrt{3}}{4} \times 1 : 3 = \frac{4}{3}\sqrt{3}$

- block 223: $V = 8\sqrt{3} + \frac{4}{3}\sqrt{3} = \frac{28}{3}\sqrt{3} \approx 16.166$

LEVEL 2 The volume of blocks 122, 133 and 233 can be calculated as follows:



Cut the block into two parts with a plane parallel to the base to obtain a regular prism and a triangular-based pyramid. Note that in this case, the base of the pyramid is a part of one of the block's lateral faces. Calculate the volume of the regular prism and the pyramid separately:

In all three cases the height of the pyramid is the height of the regular prism: $h = \frac{a\sqrt{3}}{2} = \frac{4\sqrt{3}}{2} = 2\sqrt{3}$

block 122:

- regular prism: $V = \frac{4^2\sqrt{3}}{4} \times 1 = 4\sqrt{3}$

- pyramid: $V = 1 \times 4 \times 2\sqrt{3} : 3 = \frac{8}{3}\sqrt{3}$

- block 122: $V = 4\sqrt{3} + \frac{8}{3}\sqrt{3} = \frac{20}{3}\sqrt{3} \approx 11.547$

block 133:

- regular prism: $V = \frac{4^2\sqrt{3}}{4} \times 1 = 4\sqrt{3}$

- pyramid: $V = 2 \times 4 \times 2\sqrt{3} : 3 = \frac{16}{3}\sqrt{3}$

- block 133: $V = 4\sqrt{3} + \frac{16}{3}\sqrt{3} = \frac{28}{3}\sqrt{3} \approx 16.166$

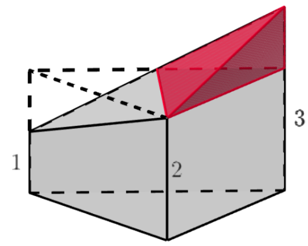
block 233:

- regular prism: $V = \frac{4^2\sqrt{3}}{4} \times 2 = 8\sqrt{3}$

- pyramid: $V = 1 \times 4 \times 2\sqrt{3} : 3 = \frac{8}{3}\sqrt{3}$

- block 233: $V = 8\sqrt{3} + \frac{8}{3}\sqrt{3} = \frac{32}{3}\sqrt{3} \approx 18.475$

LEVEL 3 The volume of blocks 123 and 132 can be calculated as follows:



Cut the block into two parts with a plane parallel to the base to obtain a regular prism and another polyhedron. The volume of the regular prism was calculated before: $V = \frac{4^2\sqrt{3}}{4} \times 1 = 4\sqrt{3}$.

Cut the block into two parts with a plane parallel to the base through the vertex of height 2. By joining the two parts, a block 111 can be obtained with a volume of $4\sqrt{3}$.

So the volume of the block 123 (and 132) is: $8\sqrt{3} \approx 13.856$.

PRIOR KNOWLEDGE Features and volume of solids (regular prism)
RECOMMENDATIONS / COMMENTS For blocks 111, 222 or 333, the calculation of the volume is easier, see 515 - Simple Volumes. In this exercise, there is also an easier method to calculate the volume of the blocks 123 and 132. This task is also suitable for differentiation, as Level 3 is much more difficult than the first two. The calculations can be verified using GeoGebra, see exercise 528 - Read the Results in GeoGebra.