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Good practices
MATH_101C_EN

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Description of the problem / exercise: **Net of a solid I.**

The following task belongs to the topic of geometry-solid geometry, different cases of a net of a solid object. Used sets: square, triangle.

The next shape is a net of a solid object body, using 1 square and 4 triangles regardless of color.

a) Which solid object's net is shown in the following picture?

b) Find the total surface area and volume of the object if each edge of the base measures 8cm!

The total surface area of a right regular square pyramid is made up of 1 square base, and 4 triangular sides that are of equal size.

The area of the square base is a^2 where a is the length of the base:

$$T = a^2 = 64\ cm^2$$

Therefore, the equilateral triangles that make up the sides are congruent, so their heights are also congruent. The slant height, m_a is the same on each face/side.

The slant height m_a can be calculated from the right triangle EFC. Since the point F is the midpoint of a base edge, $|FC| = \frac{1}{2}a$. The lateral edge length of the pyramid b is equal to the length of the base edge.

By Pythagoras' Theorem from right-triangle EFC, we have

$$m_a{}^2 = a^2 - \left(\frac{a}{2}\right)^2 = 64 - \frac{64}{4} = 48$$

$$m_a = \sqrt{48} = 6{,}93\ cm$$

Area of 1 triangle face

$$T_1 = \frac{a \cdot m_a}{2}$$

and there's 4 of them.

Thus, the lateral area $= 4 \cdot \frac{a \cdot m_a}{2} = 2 \cdot a \cdot m_a$

Total surface area of a square pyramid:

$$F = T + 4 \cdot T_1 = 64 + 4 \cdot 6{,}93 = 91{,}72\ cm^2$$

The general volume of a pyramid formula is given as:

$$V = \frac{T \cdot m}{3}$$

T is the area of the square base, *m* is the height (height from the base to the apex).

The area of the square base is a^2 where *a* is the length of the base:

$$T = a^2 = 64\ cm^2$$

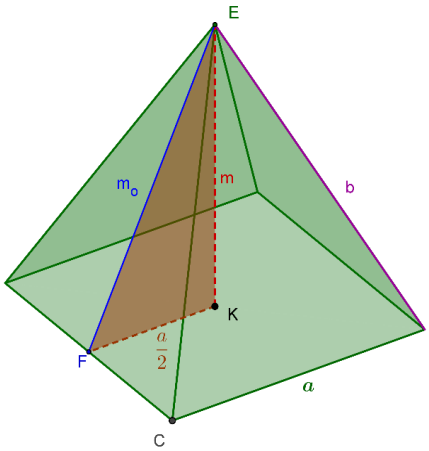
The height of the pyramid *m* can be calculated from the right triangle *EFK*. Since the point F is the midpoint of a base edge, |FK|=1/2 a.

$$m^2 = {m_a}^2 - \left(\frac{a}{2}\right)^2 = 48 - \frac{64}{4} = 32$$

$$m = \sqrt{32} = 5{,}66\ cm$$

The volume of the pyramid:

$$V = \frac{T \cdot m}{3} = \frac{64 \cdot 5{,}66}{3} = 120{,}75\ cm^3$$



- *Why this exercise is good:* Develops problem solving, logical thinking, inductive thinking, combinatorial thinking, and spatial vision.
- *Level of teacher training:* Secondary school
- *School subject(s):* Mathematics