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General Formula for Calculation of Dimensions and Surfaces of Some Geometric Figures

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Annotation: In this paper, the general formula for calculating the volumes and surfaces of some geometric figures is revealed based on the application of Simpson's formula in calculating the volume of spatial objects and the faces of some planametric shapes.

Keywords: Simpson formula, spatial body, prism, cylinder, cone, pyramid, truncated cone, truncated pyramid, sphere, parallelogram, triangle, trapezoid.

INTRODUCTION. The development of spatial imagination, logical thinking, the acquired knowledge through the systematic study of the properties of shapes in space and space in the teaching of geometry and its application in solving problems of a constructive nature by calculating these properties. is to teach the use of various devices in surface measurements, in determining surfaces and volumes, and in performing such practical work[1].

Systematic problem-solving helps to master the theory consciously and thoroughly, demonstrates its practical value, as well as problem-solving develops the student's logical thinking, creative initiative, ingenuity, and a number of necessary practical skills and abilities.

LITERATURE ANALYSIS AND METHODOLOGY. Functional analysis of geometric figures B. P. Maslov, V. N. Kolokoltsov, G. L. Built and developed in the works of Litvinov and others. M. Заричный, T. Radul, T. Banax, A. A. Zaitov, I. I. Tojiev, O. Hubal,V. Brydun, A. Savchenko, M. Cencelj, D. Repovš and others used categorical methods in their research[2].

DISCUSSION. In the process of solving problems in geometry, we face the problem of finding the volume of many spatial objects. These include various prisms, cylinders, cones, pyramids, truncated cones, truncated pyramids, and spheres. Known prism size $\boldsymbol{S}=\frac{\boldsymbol{a}_1+\boldsymbol{a}_3}{2}\cdot\boldsymbol{h}$ $V=SH$, the size of a pyramid $V=\frac{1}{3}SH$, cone size too $V=\frac{1}{3}SH$, cut pyramid $V=\frac{1}{3}H\left(S_1+\sqrt{S_1S_2}+S_2\right)$, truncated cone size $V=\frac{1}{3}\pi H\left(R^2+R\cdot r+r^2\right)$, the size of the sphere $V=\frac{4}{3}\pi R^3$ is calculated using formulas. The question is, is there a formula that is common to all of the above space objects?

This amazing formula is called the Simpson formula and it follows[3]:

$$\boldsymbol{V}=\frac{\boldsymbol{H}}{6}\left(\boldsymbol{S}_{quyi}+4\boldsymbol{S}_{o'rta}+\boldsymbol{S}_{yuqori}\right),$$

here:

S_{quyi} - past base face,

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$S_{o'rta}$ - middle cut face,

S_{yuqori} - top base face

H-height (in some cases H is substituted).

We now find the volumes of the above bodies using the Simpson formula:

1) In the form of a prism and a cylinder (Figure 1)

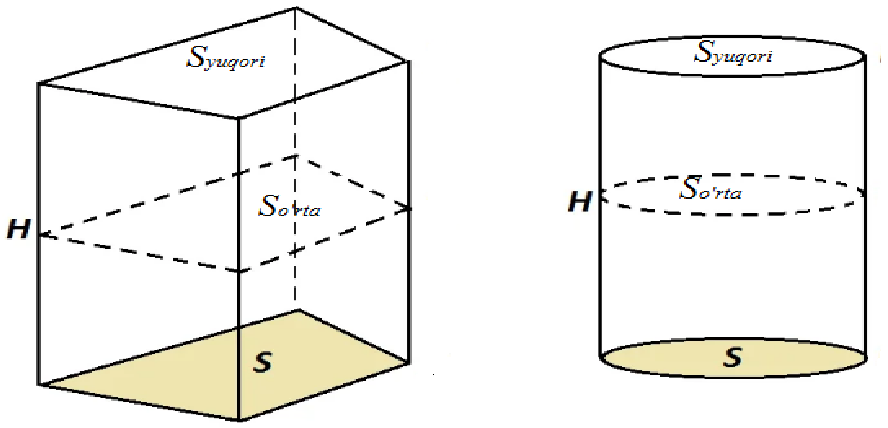

Figure 1. Prism and cylinder

$S_{quyi} = S_{(o`rta)} = S_{yuqori} = S_{asos}$

now $$\boldsymbol{V} = \frac{\boldsymbol{H}}{6}(\boldsymbol{S}_{asos} + 4\boldsymbol{S}_{asos} + \boldsymbol{S}_{asos} = \boldsymbol{S}_{asos} H$$

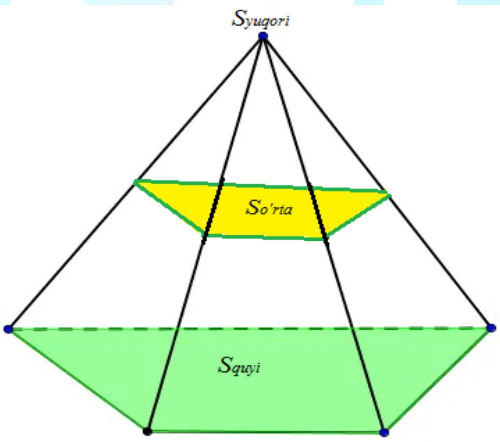

Figure 2. Pyramid

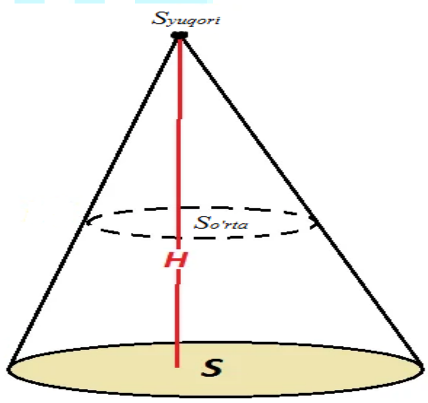

Figure 3. Cone

For pyramids and cones: (Figure 2-3) $S_{o'rta} = \frac{S_{asos}}{4}$, $S_{yuqori} = 0$

now $$\boldsymbol{V} = \frac{\boldsymbol{H}}{6}(\boldsymbol{S}_{asos} + 4.\frac{\boldsymbol{S}_{asos}}{4} + 0) = \frac{\boldsymbol{S}_{asos} \cdot \boldsymbol{H}}{3}$$

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1) For a truncated cone hole (Fig. 4))

$S_{quyi} = \pi R^2$, $S_{yuqori} = \pi r^2$, $S_{o'rta} = \pi(\frac{R+r}{2})^2$

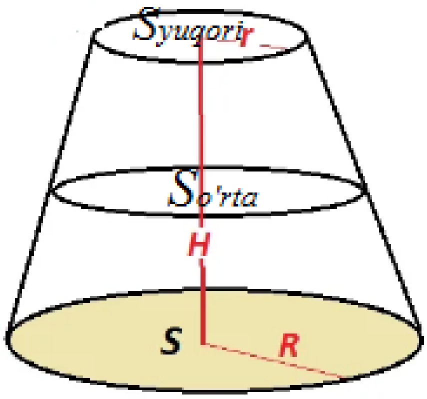

Figure 4. Cut cone

So, $V = \frac{H}{6}(\pi R^2 + 4\pi(\frac{R+r}{2})^2 + \pi r^2) = \frac{H}{6}(\pi R^2 + \pi\left(R^2 + 2Rr + r^2\right) + \pi r^2) = \frac{H}{6}\left(2\pi R^2 + 2Rr + 2\pi r^2\right) = \frac{1}{3}\pi H\left(R^2 + R \cdot r + r^2\right)$

The Simpson formula is not only for the size of spatial objects, another great feature of this formula is that it can be used to find the faces of triangles, parallelograms, trapezoids.

From the Simpson formula to the surface formulas for flat polygons in a plane, we change the volume to the surface

From the Simpson formula $V = \frac{H}{6}(S_{quyi} + 4S_{o'rta} + S_{yuqori})$ in deriving surface formulas for flat polygons in a plane V we change the volume to the surface S, S_{quyi} s a_1 the length of the cross section formed by the lower base defined by, $S_{o'rta}$ s a_2 the average cross-sectional length, S_{yuqori} ni a_3 the upper cross-sectional length, h – figure height. In this case, the Simpson formula for surfaces looks like this:

$$S = \frac{h}{6}(a_1 + 4a_2 + a_3)$$

here a_1, a_2, a_3 magnitudes consist of intersections or points.

When our figure was first a parallelogram (square, rectangle) $a_1 = a_2 = a_3$ and the surface of the parallelogram is calculated by the Simpson formula: $S = \frac{h}{6}\left(a_1 + 4a_2 + a_3\right) = \frac{h}{6}\left(a_1 + 4a_1 + a_1\right) = a_1 h$

So the face of the parallelogram: (Figure 7) $S = a_1 h$

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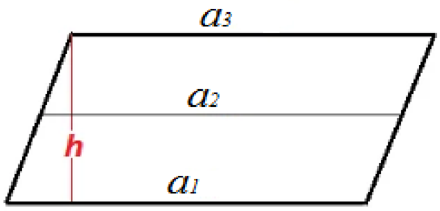

Figure 7. Parallelogram

Now we apply the Simpson formula to find the face of a triangle. For a known triangle $a_2 = \frac{a_1}{2}(\text{o'rta chiziq}),\quad a_3 = 0$ (because it consists of a point).

In that case $S = \frac{h}{6}(a_1 + 4a_2 + a_3) = \frac{h}{6}\left(a_1 + 4\frac{a_1}{2} + 0\right) = \frac{a_1 h}{2}$

So the face of the triangle: $S = \frac{a_1 h}{2}$

Now we find the trapezoidal surface using the Simpson formula.

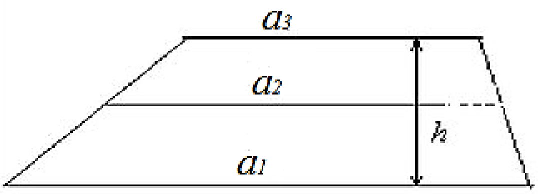

Figure 8. Trapeze

For a trapezoid, a_2 is the midline, (Figure 8) so $a_2 = \frac{a_1 + a_3}{2}$ is the midline $S = \frac{h}{6}(a_1 + 4a_2 + a_3) = \frac{h}{6}\left(a_1 + 4\cdot\frac{a_1 + a_3}{2} + a_3\right) = \frac{a_1 + a_3}{2}\cdot h$

CLEAR CONCLUSIONS AND PRACTICAL SUGGESTIONS. Hence the trapezoidal face $S = \frac{a_1 + a_3}{2}\cdot h$ that is, the base of the face of the trapezoid is equal to half the sum of the lengths and the height.

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