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RESEARCH ARTICLE OPEN ACCESS

Surface Area And Volume Of A Truncated Pyramid

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ABSTRACT

A truncated pyramid is one of the important types of spatial geometric bodies, formed by cutting the pyramid with a plane parallel to its base. This geometric figure has two parallel bases and side planes connecting them. Using the concept of a truncated pyramid, important geometric quantities such as volume, surface area, side edges and height are studied. The article extensively covers the definition, structure, elements, surfaces and formulas for calculating the volume of a truncated pyramid. It is also shown that the practical application of a truncated pyramid is of great importance in the processes of construction, architecture, engineering and technical design. This topic serves to develop spatial imagination in students and to form skills in analyzing complex geometric bodies.

Keywords: Frusted pyramid, pyramid, base, side surfaces, height, volume, surface, spatial bodies, geometry, architecture.

INTRODUCTION

Spatial geometry studies the shape, size, and location of objects in space. The pyramid and its types play an important role in this section. A truncated pyramid is a spatial object formed by cutting a pyramid with a plane parallel to its base. This geometric shape is widely used in theoretical and practical problems. By studying a truncated pyramid, students develop spatial thinking, volume, and surface area skills.

A truncated pyramid is a pyramid with its apex cut off, and it has two bases: an upper and lower base. These bases are parallel to each other and consist of polygons similar in shape. The distance between the bases is the height of the truncated pyramid. The side surfaces are in the form of a trapezoid.

A truncated pyramid consists of the following main elements:

Lower base — a base in the form of a large polygon

Upper base — a base in the form of a small polygon

Side surfaces — trapezoidal planes

Side edges — edges connecting the bases

Height — the perpendicular distance between the bases

These elements fully characterize the geometric structure of a truncated pyramid.[2]

A truncated pyramid can be of different shapes depending on the shape of the base. For example, there are triangular, rectangular, pentagonal and other multi-sided truncated

pyramids. If the base is a regular polygon, such a truncated pyramid is called a regular truncated pyramid. In regular truncated pyramids, all side edges are equal, and the side surfaces form equal trapezoids.

The lateral surface area of a truncated pyramid is the sum of all its lateral surfaces. The lateral surface area for a regular truncated pyramid is determined by the following formula:

$$S = \frac{(P_1+P_2)}{2} \times l$$

Where:

P_1 va P_2 - the perimeters of the lower and upper bases,

l— the height of the lateral surface (apotheme).

Calculating the lateral surface area is important in construction and technical projects.

Total surface area

The total surface area of a truncated pyramid is determined as follows:

$$St = S_x + S_1 + S_2$$

Where: $S_1 + S_2$ are mainly the lower and upper base surfaces. This formula allows for a complete analysis of the surfaces of geometric bodies.

Volume of a truncated pyramid

The volume of a truncated pyramid is one of the most important geometric quantities.

The truncated pyramid shape is widely used in various fields:

In architecture - in towers, roof structures and decorative elements In construction - in concrete blocks and supports

In engineering - in the form of mechanical details

In design - in the creation of decorative items

This shape is considered durable and aesthetically pleasing.[3]

Example

Find the volume of a truncated pyramid with a lower base of 36 cm², an upper base of 16 cm² and a height of 6 cm:

This example shows the practical application of the volume formula.

CONCLUSION

In conclusion, the truncated pyramid is one of the important concepts of spatial geometry, and the study of its structure and properties develops spatial thinking in students. The formulas for calculating the surface area and volume of a truncated pyramid are widely used in practical problems. This topic is closely related to the fields of architecture, engineering and construction, and is of theoretical and practical importance.

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