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SURFACE AND VOLUME OF THE CONE SURFACE

Mamaraimov Bekzod Kadirovich

Teacher of mathematics at Terdu Academic Lyceum.

Makhmudov Azam Kudratovich
Terdu Academic Lyceum Mathematics teacher.
Musurmonov Maruf Akrom ugli

mathematics teacher at Terdu Academic Lyceum.

Abstract. This article extensively covers the main properties of a cone, one of the spatial geometric shapes, in particular, methods for determining its surface area and volume. The article explains the geometric structure of a cone, the origin of its formula, mathematical approaches to calculating its surface area and volume, as well as practical examples. Knowledge about the cone is important in such disciplines as physics, engineering, and architecture, and this article can be a useful guide for students studying in these fields.

Keywords: Cone, surface area, lateral surface, volume, circle, geometric shape, formulas, mathematical modeling.

The main goal of introducing pedagogical technologies in the educational process is to make the student the main participant in the lesson. That is, it provides students with independent thinking, involvement in practical and creative activities, abandoning passive approaches such as traditional memorization and automatic repetition. Through this approach, the student not only understands the topic, but also connects it with real-life situations, develops the skills to express and justify their views on emerging problems.

Pedagogical technologies are inherently subjective and, regardless of the method, form or means by which they are implemented, perform several main tasks:

• increasing the effectiveness of pedagogical activities,

• creating an environment based on mutual trust and cooperation between the teacher and the student,

• forming deep knowledge and concepts in students,

• developing independent and creative thinking skills,

• creating the necessary pedagogical conditions for the full realization of the personal potential of each student,

• promoting democratic and humanistic principles in the educational process.

Today, innovative approaches are gaining importance in the education system. In particular, the introduction of interactive methods is becoming an integral part of modern lessons. Interactive approach is a partnership based on active dialogue between the teacher and the student, in which both parties are

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active participants in the learning and teaching process. This method, by creating a comfortable environment during the lesson, forms the ability of students to think freely, independently, express their point of view, exchange ideas and creatively approach problems.

Thus, through pedagogical technologies, the lesson process is organized not only effectively, but also meaningfully and interestingly for students. This contributes to their personal development, social activity and the formation of successful people in the future.

In addition, teaching a geometry course based on a competency-based approach in the modern educational process aims not only to form students' theoretical knowledge, but also to prepare them for independent and effective functioning in real-life situations. Through this approach, students acquire practical skills necessary for solving problematic situations encountered in professional activities, personal life and everyday life.

Competencies in mathematics, especially geometry, enable students to analyze, generalize, and approach complex problems creatively. In this competency-based approach, the main focus is on the student's ability to apply familiar knowledge and skills in new, unprecedented situations. This develops in students skills such as independent thinking, analytical approach, problem formulation, and choosing the most appropriate way to solve it.

In the process of teaching geometry based on a competency-based approach, a scientific approach to the problem is developed by gradually imagining the process of solving problems and finding a solution, that is, building a schematic model of the solution in the mind. This not only strengthens the student's mathematical knowledge, but also expands his skills such as analysis, prediction, and logical thinking.

One of the unique aspects of the geometry lesson is that each topic requires solving many practical problems. This process is a very important tool for developing competencies, especially learning and cognitive competence. Because it is learning and cognitive competence that creates the basis for students to deeply understand the knowledge they are acquiring, to be able to consistently apply it, and to independently expand their knowledge.

Thus, by teaching geometry in the continuous education system based on a competency-based approach, students are formed as independent thinkers, creative people, and problem-solvers.

Also, the essence and main goal of teaching geometry based on a competency-based approach is to form students and students in accordance with the requirements of modern society, to educate them as individuals who can actively participate in social life, think independently, and find solutions to problems. Through this approach, the educational process is not limited to imparting knowledge, but is directed towards developing the students' skills to use their knowledge and skills in real-life situations.

The use of a competency-based approach in teaching geometry at all levels, from preschool to higher education, forms students' ability to adapt to extracurricular life activities, develop logical thinking, spatial thinking, and analyze the surrounding environment through geometry. In particular, this subject develops students' creative approach to problem situations, skills in analysis, synthesis, and conclusion-making.

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The use of competency-based questions in teaching geometry is of great importance in deepening, strengthening students' theoretical knowledge, and increasing their ability to apply it in practice. Such questions help students not only understand the topic, but also understand how it can be applied in life. For students - that is, future mathematics teachers, this process allows them to acquire the pedagogical and methodological competencies necessary for professional activity, and to form students' skills in conducting lessons in a scientifically based approach.

Thus, through learning tasks and problems organized on the basis of a competency-based approach in geometry lessons, students' interest in science increases, knowledge deepens, and most importantly, the knowledge gained is raised to a level that provides useful results in life activities. This plays an important role not only in individual development, but also in the development of society.

A cone is a geometric body that consists of straight line segments connected from a single point (this point is called the apex of the cone) to all points of a circular base. The circle is the base of the cone, and the segments drawn from the apex to the points of the base are called its constructors.

A cone consists of two main parts:

• The base is a plane surface in the shape of a circle.

• The lateral surface is a smooth surface drawn from the apex of the cone to all points of the base circle.

If the straight line connecting the apex of the cone with the center of the base circle is perpendicular to the plane of the base, then this cone is called a right cone. In a right cone, its axis (i.e., the line between the apex and the center) is perpendicular to the plane of the base, which makes its geometric properties much simpler.

A cone is widely used in various fields - mathematics, physics, engineering, and design. It is found in real life in the trajectory of an ice cream cone, a roller coaster, or some building structures.

Let us consider a certain point in space and a straight line. Now we imagine all possible different straight lines starting from this point and intersecting the line. The set of these straight lines forms a unique surface in space. Such a surface is called a conical surface.

If the main element of this surface, that is, each state of the moving straight line starts from the point and intersects with the line, then the resulting surface is a conical surface or a right circular cone surface.

Such surfaces are important in geometric modeling, mechanics, and architectural structures, and their structure is determined by moving straight lines (generators). The point here plays the role of the vertex of the cone, and the line plays the role of the main guiding line tangent to the generators.

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When determining the lateral surface of a cone, its extension — that is, the position of the cone when extended on a plane — is taken as a basis. Such an extension has a shape similar to a sector of a circle. Let us assume that λ is the length of the cone (that is, the straight line between the vertex and the boundary of the base), r is the radius of the base of the cone, and the central angle of the sector formed by the extension is α degrees. In this case, the radius of the sector of the circle formed by the extension of the cone is equal to λ. The arc of the sector — that is, the length of the circle at the base in the form of an extension — is equal to the length of the base circle of the cone, which is equal to 2πr.

The formula for the surface area of a sector is expressed as:

$S_{yon} = (\pi/^2 /360°)\ \alpha$

The formula for the lateral surface area is:

$S_{yon} = \pi * r * l$

The total surface area is the sum of the base area and the side surface area:

$S_{to'liq} = \pi * r * (l + r)$

The volume of the cone is determined by the following formula:

V = 1/3 * π * r^2 * h

Example: Calculate the surface area and volume of a cone with a radius of 4 cm and a height of 9 cm.

Solution:

1. Sidebar: l = √(r^2 + h^2) = √(4^2 + 9^2) = √97 ≈ 9.85 sm
2. Full surface area: S = π * r * (r + l) ≈ 3.14 * 4 * (4 + 9.85) ≈ 173.87 sm²
3. Size : V = 1/3 * π * r^2 * h = 1/3 * 3.14 * 16 * 9 ≈ 150.72 sm³

Also, a truncated cone is a figure formed by cutting off a part of a geometric body in the shape of a regular cone by a plane. If a plane is drawn through a regular cone that is not perpendicular to its base, but intersects the axis of the cone, and this plane forms a section in the form of a circle parallel to the base of the cone, then the upper part formed is a smaller cone, and the remaining lower part is called a truncated cone.

A truncated cone is bounded by two circles, which are its bases. The small circle formed by the upper section is the upper base of the truncated cone, and the base of the original cone is the lower base.

The straight line between the centers connecting these two bases — that is, the section OO_1 connecting the centers — is called the height of the truncated cone. The height always indicates the perpendicular distance between the bases.

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The outer curved surface connecting the bases of a truncated cone is called its lateral surface. This surface is the outer surface of the original cone, part of which has been preserved as a result of cutting. The lateral surface is formed by a part of the cone builders.

Also, the parts of the builders located between the upper and lower bases of the cone are called truncated cone builders. These builders are located on the lateral surface and determine the slope of the conical shape.

That is, a truncated cone is a complex geometric shape formed from a part of the full-shaped cone, which is widely used in practice in engineering, architecture and industry. The correct analysis of this shape and the correct determination of its elements are an important part of the science of geometry.

It is also worth noting that the study of the shape of a cone is one of the important topics in geometry, since it is widely used not only in the framework of theoretical mathematics, but also in practical areas. A cone is a three-dimensional geometric shape with a circle at its base and a vertex, and determining the area and volume of its surface plays an important role in many areas.

First, in the engineering and construction industries, elements with a conical shape are often found. For example, smokestacks, domes, pipes used in bunkers, or concrete structures have conical support parts. The surface area of these elements is of primary importance in calculating material consumption, and the volume is of primary importance in determining the internal capacity.

Secondly, when conical details are used in the technology and manufacturing industries, their volume is important in determining weight and lifting capacity, and the surface area is important in planning painting, coating or other processing processes.

Third, in the education system, especially in school and higher education, by calculating the surface area and volume of a cone, spatial thinking, analytical thinking and mathematical skills are formed in students. Solving these problems teaches students the basics of calculation and logical thinking necessary for solving real-life problems.

Also, in the fields of art and design, the cone shape is of aesthetic and functional importance. In the fields of architecture, decorative arts, and graphic design, cone elements are visually and structurally important, and correctly determining their surface area and volume increases the quality of the designer's work.

In conclusion, calculating the surface area and volume of a cone is of great importance not only from the point of view of mathematical theory, but also in many practical areas. With the help of this knowledge, it is possible to save resources, ensure proper design, efficient production, and high-quality educational processes.[1]

[1] Qori N. “Geometriya asoslari”, Toshkent: O‘zbekiston milliy ensiklopediyasi nashriyoti, 2018.

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In conclusion, although the shape of a cone may seem simple, calculating its surface area and volume requires deep mathematical knowledge. The formulas and examples presented in this article not only increase theoretical knowledge, but also allow for its use in practice. In the future, this knowledge can be applied in physics, engineering, and other technical fields.

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