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Flat and Spatial Curves

Anvar Egamovich Jabborov, Feruza Islomovna Mamurova
Tashkent State Transport University

Annotation: *Polyhedra have beautiful shapes, for example, regular, semi-regular and star polyhedra. A regular polyhedron is a polyhedron whose all faces are regular equal polygons, and all dihedral angles are equal.*

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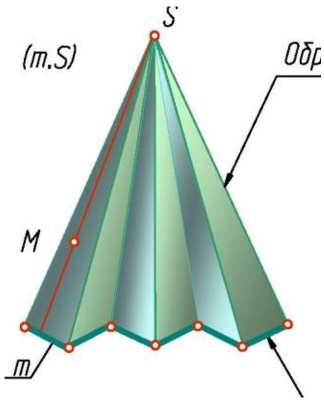
A polyhedron is a body whose boundary is the union of a finite number of polygons.

The first mention of polyhedra is known as early as three thousand years BC in Egypt and Babylon. But the theory of polyhedra is also a modern branch of mathematics. It is closely related to topology, graph theory, and is of great importance both for theoretical research on geometry and for practical applications in other branches of mathematics, for example, in algebra, number theory, applied mathematics - linear programming, optimal control theory.

Polyhedra have beautiful shapes, for example, regular, semi-regular and stellate polyhedra. They have a rich history, which is associated with the names of such scientists as Pythagoras, Euclid, and Archimedes. Polyhedra are distinguished by unusual properties, the most striking of which is formulated in Euler's theorem on the number of faces, vertices and edges of a convex polyhedron: for any convex polyhedron, the ratio $G + B - P = 2$ is valid, where G is the number of faces, B is the number of vertices, P is the number of edges of this polyhedron. Historians of mathematics call Euler's theorem the first theorem of topology, a major branch of modern mathematics.

Since ancient times, our ideas about beauty have been connected with symmetry. Perhaps this explains the human interest in polyhedra - amazing symbols of symmetry that attracted the attention of outstanding thinkers.

The history of regular polyhedra goes back to ancient times. Pythagoras and his disciples were regular polyhedra. They were struck by the beauty, perfection, harmony of these figures. The Pythagoreans considered regular polyhedra to be divine figures and used them in their philosophical writings: the fundamental principles of existence - fire, earth, air, water - were given the shape of a tetrahedron, cube, octahedron, icosahedron, respectively, and the whole universe had the shape of a dodecahedron. Later, the Pythagorean doctrine of regular polyhedra was expounded in his writings by another ancient Greek scientist, the idealist philosopher Plato. Since then, regular polyhedra have been called Platonic solids.



A regular polyhedron is a polyhedron whose all faces are regular equal polygons, and all dihedral angles are equal. But there are also such polyhedra, in which all polyhedral angles are equal, and the faces are regular, but dissimilar regular polygons. Polyhedra of this type are called equiangular-semiregular polyhedra. For the first time, polyhedra of this type were discovered by Archimedes. He described in detail 13 polyhedra, which were later named Archimedes bodies in honor of the great scientist.

These are truncated tetrahedron, truncated oxahedron, truncated icosahedron, truncated cube, truncated dodecahedron, cuboctahedron, icosododecahedron, truncated cuboctahedron, truncated icosododecahedron, rhombocuboctahedron, rhomboicosododecahedron, "flat-nosed" (snub-nosed) cube, "flat-nosed” (snub-nosed) dodecahedron.

In addition to semi-regular polyhedra from regular polyhedra - Platonic solids, it is possible to obtain so-called regular stellate polyhedra. There are only four of them; they are also called Kepler-Poinsot bodies. Kepler discovered the small dodecahedron, which he called the prickly, or hedgehog, and the large dodecahedron. Poinsot discovered two other regular stellate polyhedra, dual respectively to the first two: the large stellate dodecahedron and the large icosahedron.

A pyramid is a body formed by a flat polygon (base), a point that does not lie in the plane of this polygon (vertex), and all segments connecting the base points to the vertex. The sweep of the surface of an irregular pyramid will consist of irregular triangles of the lateral surface and an irregular triangle lying at the base, combined in one plane, and their mutual arrangement on the sweep should correspond to their mutual arrangement on orthogonal projections. Since the sides of the base of an irregular pyramid are different and the edges of the side surface are not equal to each other, first we find the full size of all the side edges. To do this, we use one of the ways to determine the full size of a straight line segment of the general position. In this case, the rotation method is used. We rotate the side edges around the axis drawn through the vertex of the pyramid S perpendicular to the plane H.

A conical surface is formed by the movement of a rectilinear generatrix along a curved guide. In this case, the generatrix passes through some fixed point S, which is called a vertex.

A cylindrical surface is formed by the movement of a rectilinear generatrix parallel to a given straight line 1 along a curved guide. Point N belongs to these surfaces, since it belongs to the generatrix / of these surfaces.

A conical surface is defined in the drawing if a guide (in shape and position) and a vertex are specified. Depending on the type of guide, the conical surface can be closed and unclosed. A body bounded by a conical surface and a plane is called a cone. A cone can be circular if there is a circle at its base

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