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Prism and sphere

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Annotation: This article describes in detail about the prism, its types and properties, the face and size of the prism surface, the perpendicular section of the prism, the edges and sides of the prism, the segment of the sphere and the circle of the sphere, the volume of the sphere and its parts.

Key words: prism, sphere, perpendicular section, sphere segment, sphere arc, radius, oblique prism.

Introduction:

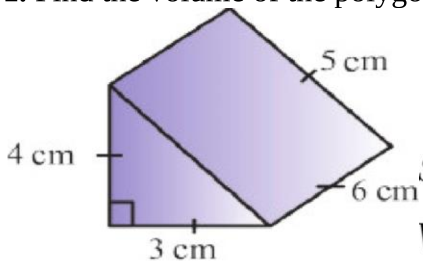
A prism is a polyhedron whose two sides, called bases, lie on parallel axes, and the remaining sides are parallelograms. If the sides are perpendicular to the base, the prism is called a right prism. A prism whose bases are regular polygons and whose sides are rectangles is called a regular prism. A right prism is a prism whose lateral edges are perpendicular to the base. Otherwise, the prism will consist of a convex prism.

Main part:

A prism is a polyhedron consisting of equal polygons whose two edges, called bases, lie in parallel planes, and all other sides are parallelograms parallel to one straight line. In this case, ABCDEF and polygons are called the bases of the prism, and parallelograms are the sides of the prism. Cross-sections where the sides of the prism intersect - the side edges of the prism, the sections AB, A_1B_1,...,FA, F_1A_1, where the sides intersect with the bases, are called the edges of the prism bases.

The vertices of the prism bases are called prism vertices, they are points. If the side edges of the prism form an angle different from the right angle with the plane of the lower base of the prism, it is called an inverted prism. If the side edges are perpendicular to the plane of the base, the prism is called a prism. The sides of a right prism also form an angle of 90° with the plane of the base. If a prism is lowered perpendicularly from an arbitrary point of the upper base to the plane of the lower base, this perpendicular is called the height of the prism.

Question 1. Find the volume of the polygons shown in the figure.



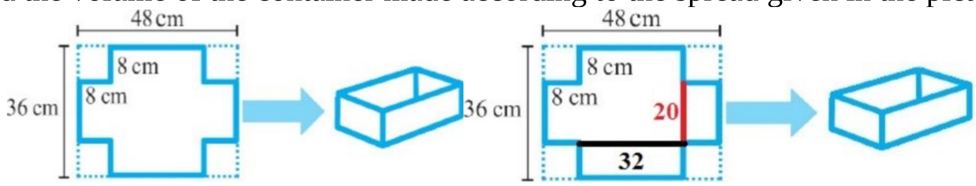
$$S_{basis} = \frac{1}{2}ab = \frac{1}{2} \cdot 3 \cdot 4 = 6$$

$$V = S_{basis}\, h = 6 \cdot 6 = 36$$

Answer: V = 36 cm^3

Solution: The base of the prism is a right-angled triangle with legs of 3 and 4 cm, height 6 cm.

Question 2. Find the volume of the container made according to the spread given in the picture.



The base of the prism is a rectangle with sides of 20 and 32 cm, and the height of the prism is 8 cm.

S_{basis} = ab = 20 · 32 = 640

V = S_{basis}h = 640 · 8 = 5120 cm^3 Answer: 5120 cm^3

It is clear that the length of the height A_1K in the prism is equal to the distance between the bases of the prism. The cross-section connecting the non-adjacent ends of the lower and upper bases of the prism is called

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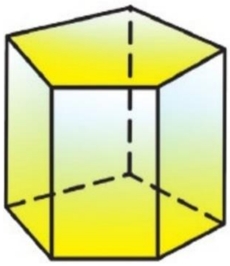
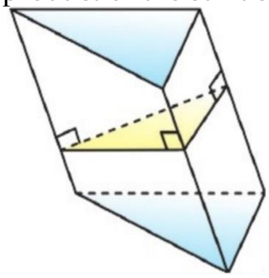
the diagonal line. We draw a plane through two side edges of the prism that are not adjacent to one side, for example. This plane intersects the bases of the prism along their corresponding diagonals.

A parallelogram is formed in the section, called the diagonal section of the prism. In other words, a diagonal section of a prism refers to a section passed through the corresponding diagonals of the prism bases. The number of diagonal sections of a prism is equal to the number of diagonals that can be drawn on one base of the prism.

Volume of the prism

The volume of a right prism is equal to the product of the surface of the base and its height: V = Sh

The volume of an arbitrary prism is equal to the product of the surface of the base and its height: V = Sh

1. $S_{side} = Pl$, P the perimeter of the perpendicular section, the length of the l-side edge.
2. $V = S_{basis}H$.
3. $V = S_{per}l$, S_{per}-perpendicular section face, l-side edge.
4. n An angular prism has 3n edges and n + 2 vertices.

Sphere and its sections

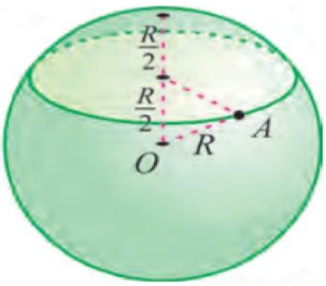
A sphere is a body consisting of all points of space not greater than a given distance from a given point. The given point is called the center of the sphere, and the given distance is called the radius of the sphere. The boundary of the sphere is called the surface of the sphere or the sphere. Thus, all points away from the center of the sphere by a distance equal to the radius are points of the sphere. The cross-section connecting the center of the sphere with any point on the surface of the sphere is also called the radius. According to the definition, the coordinates of an arbitrary point M(x; y; z) of a sphere with center A(a; b; c) and radius R

$$(x-a)^2 + (y-b)^2 + (z-c)^2 = R^2$$

The cross-section connecting two points of the sphere's surface and passing through the center of the sphere is called the diameter. Like cylinders and cones, spheres and spheres are bodies of revolution. They are formed by rotating a semicircle and a semicircle around their diameter, respectively. When a sphere is cut by an arbitrary plane, a circle is formed in the section, and the center of this circle consists of a perpendicular base lowered from the center of the sphere to the cutting plane. Let a plane with a radius R at a distance d from the center of the sphere be drawn. In this case, if d > R, the plane and the sphere have no point in common.

Question 3. A plane perpendicular to the center of the radius of the sphere is passed to it. Find the ratio of the area of the resulting section to the area of the great circle.

Solution: According to the condition, the distance from the center of the sphere to the section plane is equal to d=R/2



then the radius of the circle in the section

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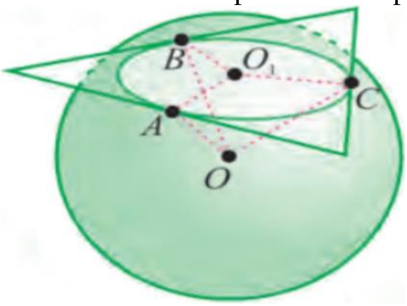
$$r=\sqrt{R^2-d^2}=\sqrt{R^2-\left(\frac{R}{2}\right)^2}=\sqrt{\frac{3}{4}R^2}=R\sqrt{\frac{3}{4}}$$

Face of section:

$$S=\pi r^2=\pi\left(R\sqrt{\frac{3}{4}}\right)^2=\frac{3}{4}\pi R^2$$

Then the ratio of the surface of the section to the surface of the great circle is $\frac{3}{4}\pi R^2:\pi R^2=\frac{3}{4}$
Answer: 3/4

Question 4. A sphere with radius R touches all sides of a regular triangle with side a. Find the distance from the center of the sphere to the plane of the triangle.



Solution: let A, B, C be the points of the triangle sides of the sphere. $O_1A = O_1B = O_1C$ O_1 is the center of the circle inscribed in the given triangle. The radius of this circle is

$$r=\frac{S}{p}=\frac{\frac{\sqrt{3}a^2}{4}}{\frac{3a}{2}}=\frac{a\sqrt{3}}{6}$$

According to the Pythagorean theorem, we find the distance we are looking for. This distance is equal to:

$$OO_1=\sqrt{OA^2-O_1A^2}=\sqrt{R^2-\left(\frac{a\sqrt{3}}{6}\right)^2}=\sqrt{R^2-\frac{3a^2}{36}}=\sqrt{R^2-\frac{a^2}{12}}$$

Answer: $\sqrt{R^2-\frac{a^2}{12}}$

The plane passing through the center of the sphere is called the diameter plane. The intersection of the diameter plane with the sphere is called the great circle, and the intersection with the sphere is called the great circle. An arbitrary diameter plane of a sphere consists of its plane of symmetry. The center of the sphere is its center of symmetry. Obviously, the sphere has only one point in common with the trial plane - the trial point. A straight line passing through the point of the ball, lying in the plane of the ball's attempt, is called the ball's attempt at that point. The attempted straight line also has only one point in common with the sphere - the attempted point. The intersection of two spheres creates a circle (a). Spheres whose point of intersection consists of only one point are called spheres that collide with each other (b).

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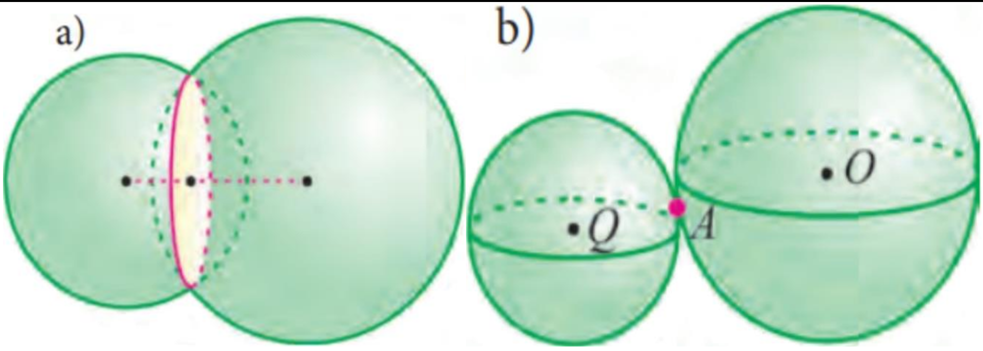

Conclusion:

In conclusion, it should be said that if we connect the points on the base of the segment of the sphere with the center of the sphere, a cone is formed, and its surface together with the segment of the sphere forms a sector of the sphere. If the segment of the sphere is larger than the hemisphere, the part of the sphere from which this cone is excluded is the sector of the sphere. The part of the sphere bounded by parallel planes cutting it is the sphere belt. The height of a segment of a sphere is the distance from the center of the base of the segment to the point of intersection of the perpendicular to the base with the surface of the sphere.

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