Section 1. Mathematic

https://doi.org/10.29013/ESR-21-1.2-3-10

Avdeev Vladimir Vasilyevich,
Candidate ofBiological Sciences, pensioner,
Vladivostok, Russian Federation

QUADRATURE A CIRCLE– A COSMOLOGICAL TASK AND A WAY TO SOLVE IT

Abstract. A method is given for solving the quadrature of a circle – a task of ancient Greek mathematics for constructing using a compass and a ruler without divisions. It is based on the principles of building a cosmological model of the Universe of Light. It has been established that the construction of a square, equal in area to a given circle, is a two-dimensional display of the metaphysical connection between the sphere of the Universe and hypercube, in volume, generated by it. Alternative formulas $S=\left(\frac{5}{4}R2\sin 45^{\circ}\right)^2$ and $V=\left(\frac{5}{4}R2\sin 45^{\circ}\right)^3$ are given to determine the area of a circle and the volume of a sphere by calculating their equal square and hypercube, respectively. These formulas are based on an analogy that can be traced between the quadrature of a circle and the trigonometric circle, in which trigonometric functions determine the relationship between the sides and the angle of a right triangle. It is this triangle, emanating from the center of the circle, which underlies the construction of the square.

Keywords: quadrature the circle, hypercube, pyramid of Cheops, cosmological model of the Universe of Light.

Introduction

As you known, in ancient Greece, along with philosophy, much attention was paid to mathematics. The main requirement in solving geometric tasks was the condition to use only compass and a ruler without divisions for constructions. However, over time, a number of tasks appeared, the solution of which was impossible under this condition. Among them, the most famous are the three classical tasks of ancient Greece mathematics: squaring a circle, doubling a cube, and dividing an angle into three equal parts. Since ancient times, many famous mathematicians have tried to solve them. Further, it was concluded that it is impossible to obtain a positive result without to use of additional devices.

Naturally, the desire to solve these tasks played a positive role. Many discoveries have been made. Nevertheless, it is unlikely that the main purpose the appearance of these tasks was to attract the human mind to improve the mathematical methods of condition and the emergence of new ideas in geometry and algebra. The need to comply with a given construction for solving these tasks indicates that their authors pursued a certain goal. It will become clear further, when we realize the metaphysical essence hidden in them, indicating their cosmological significance. In this article the subject of consideration is the quadrature of a circle. This is the first step in solving the above three tasks of ancient Greek mathematics.

Material and methods

To solve this task, a cosmological model of the Universe was used, which is conceptually different from existing models. The principles of its construction are outlined by me in the 1st volume "The Universe of Light: two keys to the secrets of the Universe" [1]. Its modeling is based on a series of constructions using compass and ruler without divisions. A clear illustration of this method of construction is Figure 1. This became the basis for solving the task of quadrature a circle using the following principles applied in modeling the stress structure of the three-dimensional sphere of the Universe of Light:

1. Geometric constructions must be carried out with the help of a circle, which is a two-dimensional display of the sphere of the outflow energy of the primordial Light from a point charge of creation.

2. The formation of the structure of the tension of the Universe became possible due to the interaction of the sphere of the outflowing Light with the twelve spheres of its reflection. At the two-dimensional level of display, we are talking about the interaction on the circumference of a circle with the circumferences of six circles of its reflection. Therefore, when solving the task under consideration, it is necessary to use the principle of building on the relationship of a give circle with the circles of its mirror reflection.

If we follow the listed cosmological principles of creation, then it becomes clear why, to solve the quadrature of the circle, as well the other two tasks mentioned above, attention was focused on the use of a compass and ruler. Using the first tool, you can embody the idea of circle, and use a ruler to connect the intersection points of mirror-symmetrical circumferences, and thereby, with the help of straight-line elements, carry out the necessary constructions.

Modeling the process of emergence and formation of the structure of the static tension of the three-dimensional sphere of the Universe showed that the construction of geometric figures is based on number from 1 to 10. Those in the metaphysics of the construction of the Universe are 28 conventional units of the potential of creation, the esoteric sum of which is 10. It should also be noted the significance of the center of the sphere of the Universe as a point of creation, relative to which the formation of the structure of its tension took place. This is an important circumstance, which, when solving the task under consideration, requires construction relative to the center of the circle.

Two-dimensional constructions have sown that the interpenetration of the circumferences of the circle of the outflowing Light and six circles of its reflection leads to the appearance of the contours of the sections of six lenses located in circular symmetry relative to the center of creation. They are sources of formation in their focal planes of one-dimensional elements of tension (strings), and of them – two-dimensional figures that do not violate the symmetry and balance of the bipolar circular system of opposing forces of Light.

In terms of the sequence of formation of the structure of tension of the three-dimensional sphere of the Universe, the first figure on the two-dimensional display level is an equilateral triangle, which geometrically embodies the number 3. Two such tringles, having a common side, form a rhombus in the ray of opposing forces of Light (Fig. 1). Six equilateral triangles inside the circle of outflowing Light form a hexagon of tension.

During the transition to the three-dimensional level of perception, we are dealing with twelve rays emanating in spherical symmetry from the center of the Universe. This is a consequence of the synthesis of the sphere of the outflow of Light and the twelve spheres of its reflection. Double circles of the counter movement of the energy of Light in their lenses form a closed circular-spherical dynamic system of formation of the structure of tension of the sphere of the Universe, which is represented by the icosahedron, dodecahedron, hypercube, tetrahedron and octahedron.

It this sequence, these 3D solids optimize the tension space. A fragment this structure is shown in Figure 2.

Thus, taking into account the understanding of what two-dimensional figures these polyhedral are formed from, it can be argued that in the considered cosmological model of the Universe, as a whole, there are a circle, the number 3, a triangle, a square and cube. As you can see, these mathematical concepts are key words in defining the essence of the three ancient Greek tasks.

Quadrature the circle

This task is reduced to finding a way to construct a square, equal in area to a give circle, using a compass and a ruler without divisions. The key to its solution lies in recognizing, in addition to the above two principles of manifestation of the dual power of the primordial Light that created the Universe, the role of the number 10, which encompasses all arithmetic and harmonic proportions. With this in mind, let´s look at Figure. 3.a, which shows the circumferences of a given circle, increasing in size, and the lines of its two diameters, perpendicular to each other. Two circles of reflection are displayed on one of the semi-axes. Their centers are located at even levels, which correspond to principle of the completeness of the formation of a particular structure. The circumferences of these circles, passing through the center of manifestation intersect with the circumferences of the given circle.

The next step is connected with the construction of straight lines perpendicular to the considered semi axis. This is achieved by connecting the points of intersection of the circumferences of reflection circles with the circumferences of the given circle. As a result, we see that the circumferences of the last circle pass through the centers of the reflection circles. The construction of these lines obeys the principle of multiplicity 2. For example, for the first circle of reflection, the center of which is at the second level, the vertical line will run tangentially to the given circle of the first level of manifestation. In the second case, this ratio will be represented by a proportion of 4:2.

Now, following the third of the indicated principles of creation, we will construct 10 circles, which will reflect the consistent increase a given circle (Fig. 3.b). Next, we extend the horizontal and vertical axes of symmetry. Using the construction method described above, we will position the reflection circles relative to the given circle, placing their centers on four semi-axes. To do this, from each even level, we will carry out circular movements of the compass away from center of creation, limiting them to that circumference of a given circle that passes through the corresponding center of reflection. This allows you to build five perpendicular lines.

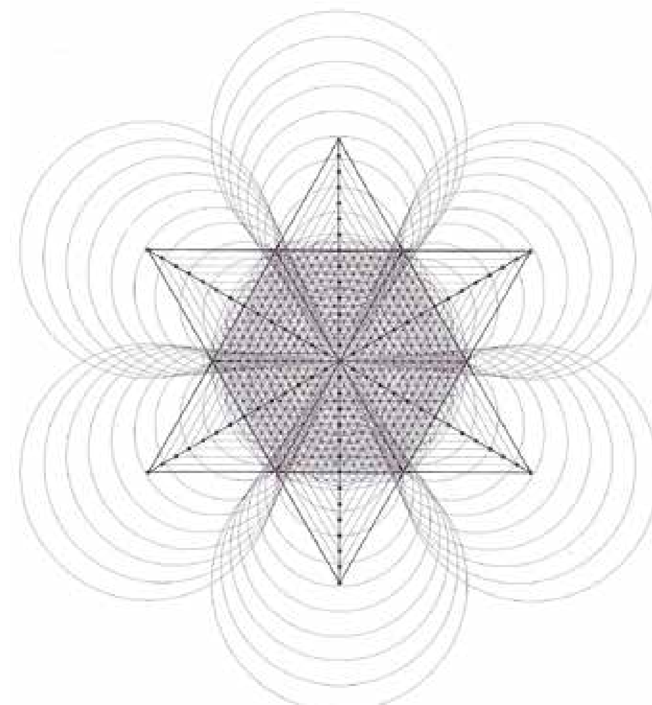

Figure 1. An example of building a structure of a three-dimensional sphere of the Universe of Light with a compass and ruler without (2D display) [1]

This matrix, built only with a compass and a ruler without divisions, is the embodiment of the three principles of creation mentioned above. It allows you to build a square equal in size to one of the areas bounded by the circumferences of a circle, increasing in size. As you can see, there are five of them, and they form scales from the corresponding number of divisions relative to the center of the matrix construction on each semi-axis. Additionally, we will draw radius-vectors along the diagonals, which will denote four directions of movement in the rectangular coordinate system of the vertices of counter of the desired square until it reaches the required size that satisfies the condition of the task under consideration.

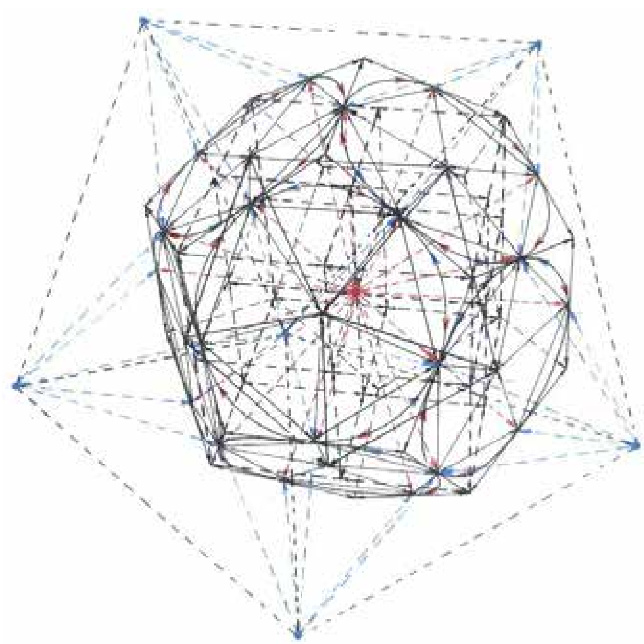

Figure 2. Circles of the counter motion of the energy of Light in the rays as a dynamic torsion force in the formation of the dodecahedron and hypercube of stress structure of the three-dimensional sphere of the Universe [1]

For each semi-axis. They, intersecting, form a square matrix, the area of which will consist of 100 (10^2) cells.

This matrix, built only with a compass and a ruler without divisions, is the embodiment of the three principles of creation mentioned above. It allows you to build a square equal in size to one of the areas bounded by the circumferences of a circle, increasing in size. As you can see, there are five of them, and they form scales from the corresponding number of divisions relative to the center of the matrix construction on each semi-axis. Additionally, we will draw radius-vectors along the diagonals, which will denote four directions of movement in the rectangular coordinate system of the vertices of counter of the desired square until it reaches the required size that satisfies the condition of the task under consideration.

To establish this moment, it is necessary to pay attention on the peculiarity of the passage of the circumferences of the circle through the cells of the matrix located on the radius-vectors. With the exception of the first A1B1C1D1 square, which consistent of 4 cells, here we are talking about the corner cells of the $A_2B_2C_2D_2 - A_5B_5C_5D_5$ squares. All squares tangentially surround the corresponding circumferences. Upon careful study, it becomes obvious that the circumference of a circle with a radius equal to 5 cells of the matrix, unlike other circumferences, diagonally crosses the vertices of the corner cells of the $A_4B_4C_4D_4$ square, belonging to a circle with a radius of 4 cells. As a result, the fifth circumference of the circle of the circle cuts of 8 parts from perimeter of the square of the fourth level, each of which is equal to the side of the matrix cell. This violates the integrity of this square.

Let´s restore its shape by connecting the intersection points of the fifth circumference of the given circle and the radius-vectors. As a result we will get required square *EFGH*, the area of which will be equal to the area of a circle with a radius equal to 4 cells. This can be see if, to find the length of its side, apply the formula

$$x^2 = \pi R^2. \quad (1)$$

For a more accurate calculation, let´s move on to a linear measurement taking into account that in the matrix under consideration, the cell side length is 8 mm. This corresponds to the initial radius of the circle, which will be 32 mm (8·4) when the quadrature of the circle is embodied. Thus, converting the formula in question to

$$x = \sqrt{\pi} R \approx 1.772R \quad (2)$$

and entering the specified radius value. We get the number 56.704, which corresponds to the length of the side of the *EFGH* square.

It is established that the side of the desired square is 56.704:64 = 0.886 of the length of the diameter of a circle of equal size. The resulting number practically coincides with the number 0.888 in the formula

$$S = \left(\frac{8}{9}d\right)^2 = (0.888d)^2, \qquad (3)$$

which was used in ancient Egypt when calculating the area of a circle. The Egyptians knew that it was equal to the area of a square with a side of $\frac{8}{9}d$. The legitimacy of using the considered method of constructing with a compass and a ruler in solving the task of quadrature a circle also become obvious if we take the radius of a circle as a unit of measurement. Then you need to use the equation

$$x^2 = \pi, \qquad (4)$$

which can be converted to

$$x = \sqrt{\pi}. \qquad (5)$$

In this case finding the length of the side of the square is reduced to finding the middle member of the proportion 32:1 = x: 1.772, where x = =32·1.772:1 = 56.704.

Thus, the side of the constructed square, equal in area to a circle represents the length π. Based on the foregoing, it follows that area of the considered square and circle, respectively, will be equal to $56.704^2 = 3215.34$ and $3.14 \cdot 32^2 = 3215.36$. The obtained values testify to this.

Now it is necessary to remember that the construction of the matrix was carried out using reflection circles, the centers of which were located on the semi-axes of a given circle. If these semi-axes considered as the axes of a rectangular coordinate system, then the solution of the quadrature of the circle can be implemented using trigonometric functions. They define the relationship between the sides and angle of a right triangle. For this, let us turn to Figure 4, where the circle with radius-vector of 5 is a trigonometric circle. In the structure of the square matrix, in which this circle is inscribed, with respect to four radius-vectors, we have eight right-angled triangles with an angle equal 45°, in the center of the formation of an equal area square *EFGH*. Using the example of a right-angled triangle *OGI*, it can be seen that sine function is determined by ratio of the opposite leg of the *GI*, equal to ½ of the side of the *GH* of the square under consideration, to the hypotenuse of the *OG*. For a given angle, the sine will be equal $\frac{\sqrt{2}}{2}$, which is equal to 0.707. It follows that when determining the length of the side of the square in the values of the trigonometric function under consideration, it is necessary to additionally use the fourth quarter, where it has a negative value.

The polarity of the sines corresponds to the metaphysics of the increase in the considered side of the square when two of its vertices move along the radius-vectors from the *OX* axis. Therefore, when determining its length, it is necessary to take into account the sum of the absolute values of two sines with opposite sines with opposite signs. This pattern extends to other sides of the square. If we consider the sides together, then their synchronous stretching with an increase in the square corresponds to the transverse distribution of the polar values of the sine.

This is observed when considering eight right triangles around the center of trigonometric circle, where in each of them the opposite leg and hypotenuse is connected by a sine function. As applied to the cosmological model of the Universe under consideration, the sine determines the ratio of spatial strings to radius-vectors of the dual force of Light during the formation of the crystal lattice of the hypercube. The construction of a square matrix by arranging reflection circles relative to a given circle, there is information about the method for constructing a hypercube of a three-dimensional sphere of the Universe.

As you known, in 1882 *F*. Lindeman proved that the number π is transcendental, that is, it does not satisfy any algebraic equation with integers. This becomes the basis for concluding that is impossible to solve the quadrature of a circle using a compass and a rule without divisions. However, the considered method of construction indicates the opposite.

Moreover, it becomes possible to substantiate a formula that makes it possible to determine the area of a circle by determining the area of a square equal of it, without involving the number π.

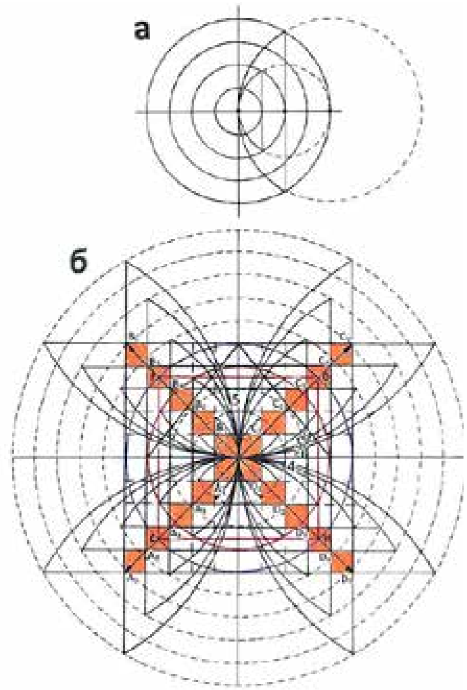

Figure 3. Construction of a square equal in area to a given circle

Recall that the main element of the construction in the matrix of the *EFGH* square, equal in size to a given circle was the circumference of a circle with a radius equal to 5 cells. The sought square, in contrast to the $A_4B_4C_4D_4$ square, intersect a circle with a radius equal to 4 cells. This indicates that the numbers 5 and 4 in the natural series of the Pythagorean decade are those steps that, in relation to each other, determine the moment of manifestation of the equal of the areas of a circle and a square in their joint increase from the center of creation. The ratio of these numbers can be expressed as a fraction $\frac{5}{4}$, where the numerator reflects the value of the unit radius-vector of the trigonometric circle, and the denominator is that part of it that determines the size of the circle, equal in size to the square, whose sides in relation to the hypotenuses of right triangles are lines connecting the polar values of the sines.

Thus, it can be stated that the indicated that indicated fraction conversion factor of a circle with any radius into a functional connection with a trigonometric circle to find its area through the line $2\sin 45^\circ = \sqrt{2}$. In general, the formula for finding the area of a circle will look like

$$S = \left(\frac{5}{4}R2\sin 45^\circ\right)^2 = \left(\frac{5}{4}R\sqrt{2}\right)^2. \qquad (6)$$

Let´s compare the calculation of the area of a circle with a radius 32 using this formula with its calculation using the formula

$$S = \pi R^2. \qquad (7)$$

In this first case $S = \left(\frac{5}{4}32 \cdot 1.414\right)^2 = 3199.03$, and in the second case – $S = 3.14 \cdot 32^2 = 3215.36$. In percentage terms, both values coincide by 99.5%, which indicates their practical equality.

It should be especially noted that the alternative formula for finding the area of a circle is a mathematical representation of the hidden geometry of the transition from the transcendental number π, which reflect the ratio of the circumference to the diameter, to the number expressing the length of the side of the square, which is equal in area to the given circle. This becomes apparent when multiplying the numbers $\left(\frac{5}{4}32 \cdot 1.414\right)$ in brackets of the consideration formula. As a result, we get the number 56.56, which practically corresponds of the length π (56.704) established above by the formula (2) when finding the side of the square, equal in size to this circle.

It should be recalled that the proposed formula for finding the area of a circle is directly related to the quadrature of the circle as one of the aspects of constructing the structure of the Universe by the sphere of the outflow of Light in conjunction with the twelve spheres of its reflection. At the two-dimensional level of displaying this process, the square and the circle are inextricably linked with each other, where the last figure in conjugation with the circles of reflection in relation to the first figure is the figure that generates it. This fundamentally distinguishes the calculation of the area according to the formula under consideration from the calculation according to the formula (7). Nevertheless, the obtained values are close and those 0.5% by which they differ from each other lose their on the scale of the Universe.

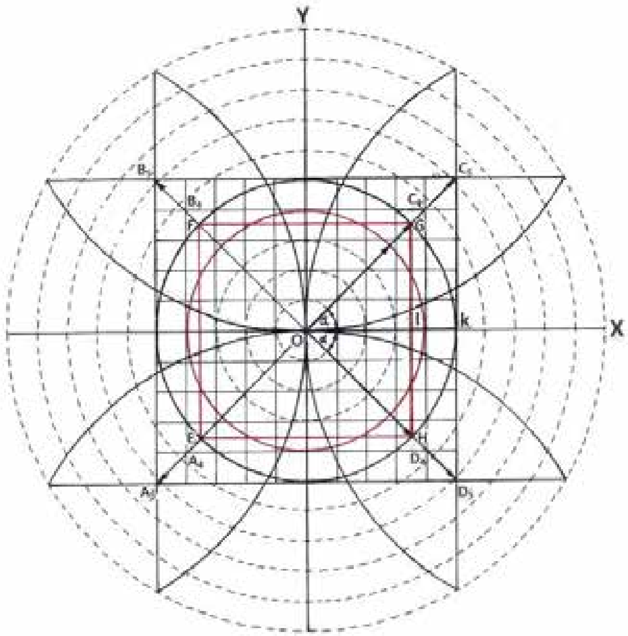

Figure 4. Quadrature the circle and its connection with the trigonometric circle

The reason for this coincidence is the presence in both formulas for calculating the area of a circle of its connection with the center. In one case, it is carried out through the number π, which establishes the ratio of the circumference to the diameter. In the second case, as already noted, we are dealing with the possibility of transferring any circle into a functional connection with a trigonometric circle, which allows us to find its area by the value of 2sin45° by calculating the area of a square equal to it.

The noted connection of a circle and a square with their common center of origin corresponds to one of the metaphysical model of the universe of Light. When modeling, it was found that inside the three-dimensional sphere of the Universe there are five regular polyhedral, among which the cubic form is represented by an octal hypercube (Fig. 2). This polyhedron is the main volumetric body of the structure of tension, which ensures the stability and strength of the luminous frame of the Universe.

The geometric method applied above made it possible not only to construct a square matrix as the main tool in solving the task of quadrature a circle, but also to come to the understanding that it identifies one of the three planes perpendicular to each other. It, passing through the center of the Universe, divides the hypercube in half. The emergence of f square matrix is similar to the formation of a hypercube, which, like other polyhedral, arises as a result of the interaction of the sphere of outflow Light with the twelve spheres of its reflection.

In this regard, the question arises of the possibility of converting the formula (6) in the formula

$$V = \left(\frac{5}{4}R2\sin 45^{\circ}\right)^{3} \qquad (8)$$

to find the volume of a sphere by establishing the volume of an equal-sized hypercube with an edge equal in length to the side of an equal-sized square *EFRGH*. According to this formula we obtain the volume of the sphere equal to $\left(\frac{5}{4}\cdot 32\cdot 1.414\right)^{3} = 180937.34$, and for the hypercube it will be equal to 56.704^{3} = 182322.84. The coincidence of the obtained is 99.2%, which indicates their practical equality.

Now let´s find out which of the matrix circumference in figure 4 is a one-dimensional mapping of a sphere equal in value to a hypercube. This is the circumference of trigonometric circle, since its radius-vector *OG*, which is the hypotenuse of a right triangle *OGI*, is equal to 5 cells of the matrix, which is equal 40 mm in a linear measure. It is this number $\frac{5}{4}\cdot 32 = 40$ that is obtained by applying the coefficient $\frac{5}{4}$ to the radius of the circle when translating in into a functional connection with the trigonometric circle in the formula (6).

A different situation arises when using a radius 32 mm in the case of calculating the volume of a sphere using the traditional formula

$$V = \frac{4}{3}\pi R^{3}. \qquad (9)$$

Then we get a volume equal $\frac{4}{3}\cdot 3.14\cdot 32^3 = 137188.69$, which is $\approx 25\%$ less than the volume of the sphere calculated by the formula (8). The reason for this difference lies in different nature of the formation of the compared spheres hidden in the formulas for calculating their volumes. In the formula where the trigonometric function $2sin45°$ is present, the sphere does not exist on its reflection. A two-dimensional analogue of its manifestation in the form of a three-dimensional sphere that generates the bodies of polyhedral is the method of constructing a square matrix. In it, the trigonometric circle acquires a metaphysical aspect, reflecting at the two-dimensional level of perception the connection between the sphere of the Universe and the structure of the octal hypercube generated by it.

If we argue from position of three-dimensional bodies, then the formula (9) for calculating the volume of a ball, in contrast to the formula (7) for finding the area of a circle, does not reflect its connection with the center, in this case it exist by itself as a material body, which does not generate bodies of polyhedral. The essence of the discrepancy lies in the justification of this formula by Archimedes. This thinker, in his reasoning regarding the method of finding the volume of a ball, proceeded from the fact that half of the ball can be reflected using a cylinder and a cone. He came to the conclusion that if the volume of the cone is subtracted from the volume of the cylinder, you can get the volume of half the ball

$$\left(\frac{1}{2}V = \pi R^3 - \frac{1}{3}\pi R^3\right). \quad (10)$$

Then the above formula will be for calculating its total volume. Thus, this formula reflects the determination of the volume of a ball by establishing the difference between the volumes of a cylinder and a cone, the formulas of which like fore a ball, are applicable to materialized three-dimensional bodies.

Concluding this article, it is necessary to pay attention to one important circumstance that concerns the numbers 5 and 4. They played a key role in constructing square equal in area to a given circle, using a compass and a ruler. As is known, these numbers determine the length of legs of a right-angled triangle, which underlies the contour of the vertical section of the Great Pyramid of Cheops. They, respectively, reflect the ratio between the height and $\frac{1}{2}$ of the base of the pyramid. This is shown in (Fig. 3 b), where the location of its contour ideally matches the purpose of the construction. This confirms the existing opinion about this pyramid as an example of a true quadrature of a circle.

Conclusions:

1. Solving the task of quadrature a circle using the principles of constructing the structure of a three-dimensional sphere of the Universe made it possible not only to obtain a positive result, but also to come to an understanding of its cosmological significance.

2. The construction of a square equal in area to a given circle is a two-dimensional representation of the formation of an octal hypercube – one of the polyhedral of the structure of tension of the sphere of the Universe.

References:

1. Avdeev V. V. Universe of Light: two keys to the secrets of the Universe.– Ekaterinburg: Ridero, 2018.– 583 p.
2. Depman I. Ya. π winner – Ferdinand Lindeman//Scientific Notes of the Pedagogical Institute named after A. I. Herze.– St. Petersburg, 1957.– T. 2.–№ 17.– P. 119–123.