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POSITIONAL BASED ON THEORETICAL KNOWLEDGE AND METRIC ISSUES WORK

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Annotasiya: Maqolada muhandislik grafikasida o‘rganiladigan metrik va pozision masalalar yechishda nazariy bilimlar asosida qo‘lda amalda bajarishni taklif qilishgan. Nazariy bilimlar chizmalarni o‘qishni, berilishiga qarab narsalarni fazoviy tasavvur qilishni, masalani yechish uchun qanday amallarni bajarish zarurligini o‘rgatadi, qonun va qoidalari bilan tanishtiradi

Kalit s‘ozlar: ta’lim texnologiyalari; dasturlash; muhandislik grafikasi; metrik masala; pozision masala; taqqoslash; fazoviy tasavvur.

РЕШЕНИЕ ПОЗИЦИОННЫХ И МЕТРИЧЕСКИХ ЗАДАЧ НА ОСНОВЕ ТЕОРЕТИЧЕСКИХ ЗНАНИЙ

Аннотация: В статье предлагается решение метрических и позиционных задач, изучаемых в инженерной графике, на основе теоретических знаний. Теоретические знания учат чтению чертежей, пространственному представлению предметов в зависимости от заданного, какие действия необходимо предпринять для решения задачи, знакомят с законами и правилами.

Ключевые слова: образовательные технологии; инженерная графика; метрическая задача; позиционная задача; сравнение; пространственное воображение; компьютерная графика.

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Abstract : The article proposes the solution of metric and positional problems studied in engineering graphics based on theoretical knowledge. Theoretical knowledge teaches the reading of drawings, the spatial representation of objects depending on the set, what actions need to be taken to solve the problem, and introduces laws and rules..

Key words: educational technologies; computer technology; engineering graphics; metric task; positional task; comparison; spatial imagination; computer graphics.

In higher education and further education, it is necessary to know the properties of basic projection in science in order to work positional and metric issues from engineering graphics. Without keeping the following properties in mind, solving problems using rules and methods based on these properties is inefficient.

1. The projection of the point will be the point.
2. The projection of a straight line will be a straight line. The projection of a straight line passing through the center or parallel to the direction of light (the projection) will be the point.
3. If a point lies on a line, the projection of such a point is on the projection of that line.
4. The ratio of straight line sections is equal to the ratio of their projections, i.e., $\frac{AC}{CB} = \frac{ac}{cb}$.
5. The projections of parallel straight lines are also parallel to each other. If $AB \parallel CD$, it will be $ab \parallel cd$.
6. If the plane of the angle is not parallel to the projection plane, its projection will not be equal to itself. Only in special cases, the sides of an angle relative to the projection plane of its projection will be equal to itself.

When the plane of any angle of magnitude 0˚ to 180˚ is parallel to the projection plane, its projection is self-equal. Figure 1 depicts straight $\angle B_1A_1C_1=\angle BAC$ with sides parallel to the H plane, sharp $\angle C_1A_1D_1$=CAD and impenetrable angle $B_1A_1D_1=\angle BAD$ angles.

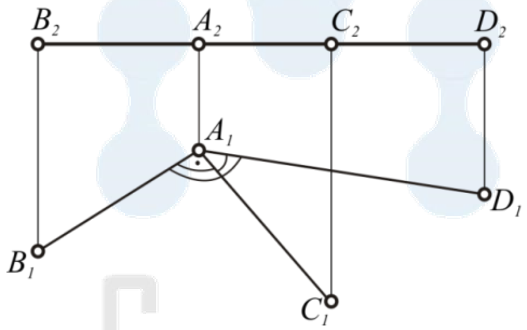

Fig. 1

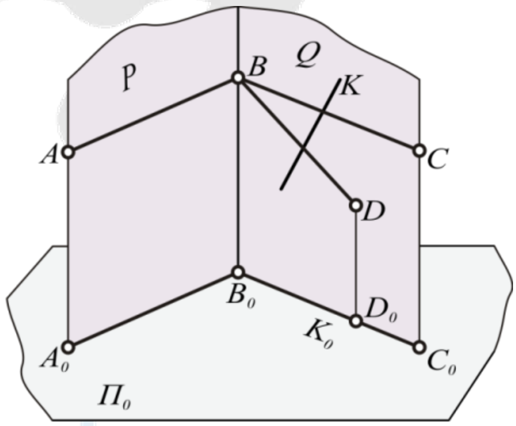

Fig. 2

When one side of a right angle is parallel to the projection plane, its projection is also a right angle.

Let in space both sides are given a right angle that is parallel to the projective plane – P_0 (Fig. 2). $\angle ABC=90˚ \Rightarrow A_0B_0C_0=90˚$.

From the second side, the planes P and Q that project the sides of the right angle ABC to the plane P_0 are also mutually perpendicular: P β Q, which means AB β Q.

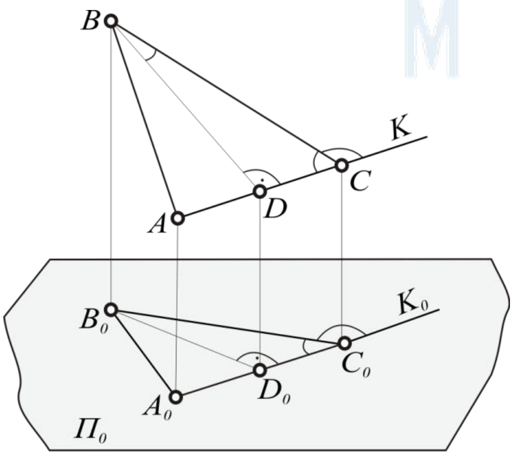

Fig. 3

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Therefore, any BD lying in the Q-plane, as well as the K-straight lines lying on AB, are also perpendicular to AB. So, ∠ABD=∠$A_0B_0D_0$=90˚; ∠ABK=∠$A_0B_0K_0$=90˚.

If one side of a sharp or impenetrable angle is parallel to the projection plane, the projection of the impenetrable angle is smaller than its own, the projection of the impenetrable angle is greater than its own.

Let the side of the alternating current ΔABC be parallel to the plane P0 (Fig.3). The perpendicular BD is lowered from the vertex B of the triangle to the side AC. Where C_0D_0=CD, b_0d_0<BD, b_0c_0<BC means ∠$d_0b_0c_0$=90, because ∠BDC is the right angle. Therefore, BCD will be smaller than the $b_0c_0d_0$ projection of the acute angle itself. The projection of the BCK impermeable angle adjacent to the BCD angle is greater than itself, i.e. ∠$b_0c_0k_0$>∠BCK. This property can also be proved by the example of the angle at the base of the diagonal and side of the cube (Fig. 4).

Where ACD is parallel to the plane of projection of the CD side of the acute angle, C_0D_0=CD. Since ∠CDA=90, ∠$c_0d_0a_0$=90. Where A_0D_0<AD and A_0C_0<AC. Hence, ∠$A_0C_0D_0$<∠ACD.

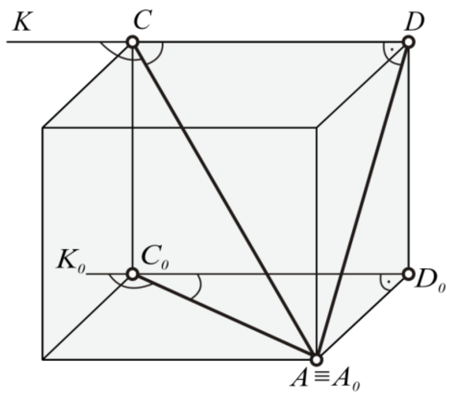


Fig. 4

Therefore, the obtuse angle $A_0C_0K_0$ that completes the acute angle $A_0C_0D_0$ by 180˚ is greater than itself, i.e. ∠$A_0C_0K_0$ >∠ACK.

1-Task. Given a straight line MN and a point A that does not lie on it (Fig. 5).

It is necessary to find: ABC is an equilateral triangle. Let the base of the triangle be the side BC to the straight line MN and be equal to the height of the triangle.

1. So, first, it is necessary to determine the shortest distance from point A to the straight line MN. For this, a plane is drawn from point A to A ϵ R (*ff ʹ*, *hhʹ*) ⊥MN.

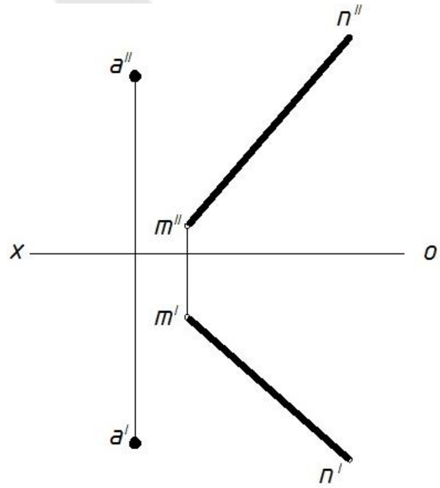
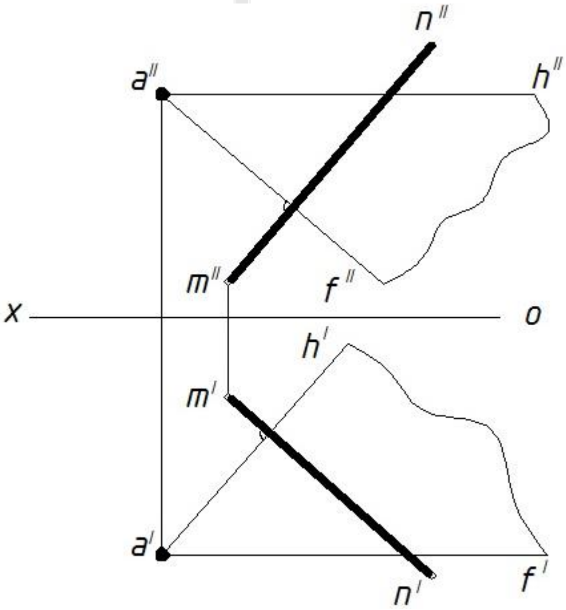


Fig. 5



2. Then, the plane P (MNϵP) is passed through the straight line MN, and P∩R is their intersection line 1, 2 is the point of intersection of the line MN with the plane R (MN∩R) kkʹ is defined. AK is the height of the triangle.

Fig. 6

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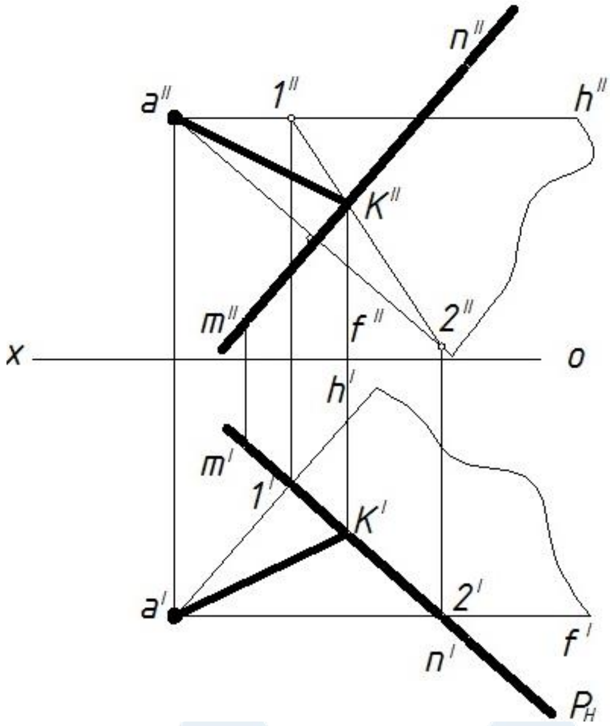

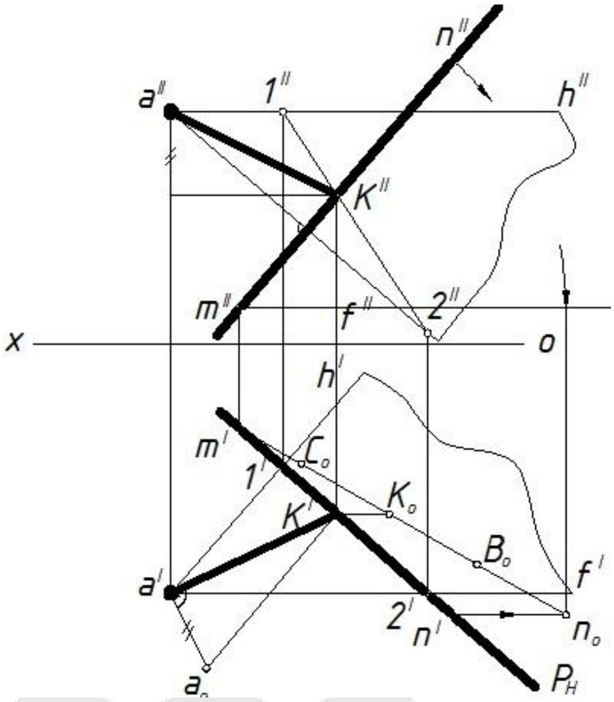

Fig.7

Fig.8

3. To place the side BC of the triangle ABC on the MN, the straight line is rotated around the point M of the line MN until it is parallel to the plane of horizontal projections, and the true length of the line MN is found MN_0. In it, K_0 is determined, and the actual size of the distance AK is measured in two directions (C_0B_0) equal to half the length of K A_0.

4. Based on C_0B_0, cb is determined.

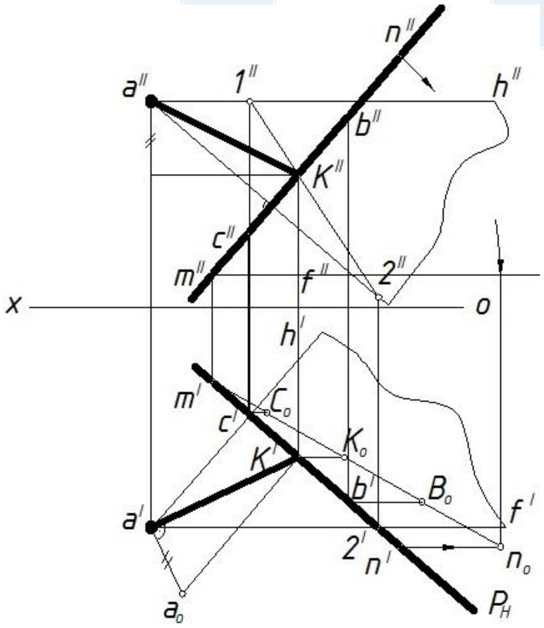

Fig.9

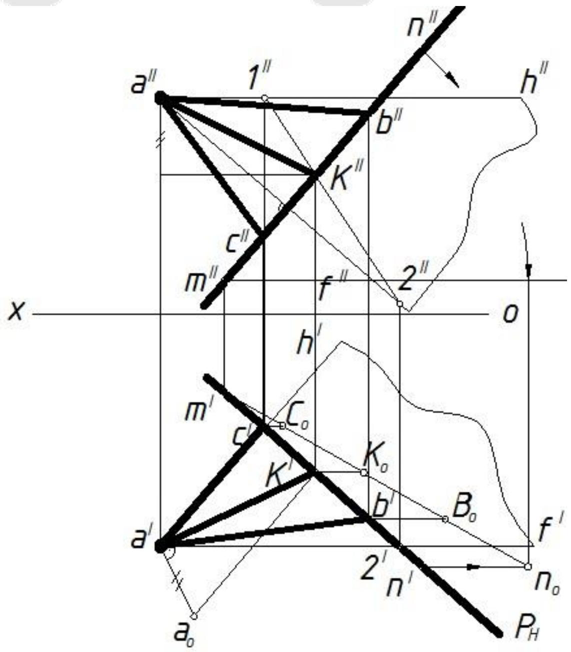

Fig.10

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5. ABC (*abc, a'b'c'*) is an equilateral triangle whose side BC is on the straight line MN, and whose length is equal to the height of the triangle (AK).

2-Task. MN is a straight line in the general case, and the frontal projection of the cross section AB in the general case (AB∩MN) intersecting the straight line MN at right angles is given.

It is necessary to determine: complete the projections of the missing sides of the square ABCD, whose side BC is on the line MN.

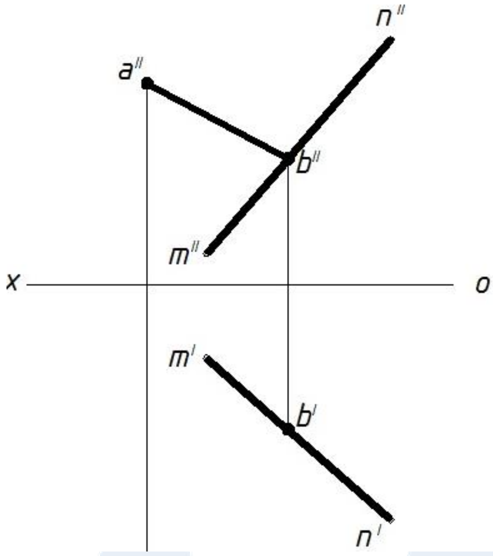

Fig. 11

1. First, find the missing projection of side AB of square ABCD. For this, a perpendicular plane R (*ff'*, *hh'*) is passed through the point B to the line MN. BϵR⊥MN.

2. An optional generator 1, 2 (1 2, 1′ 2′) passing through a′ is passed in the R plane. 1 2ϵR (*ff'*, *hh'*). Point a is marked on line 1 2 and ab is found.

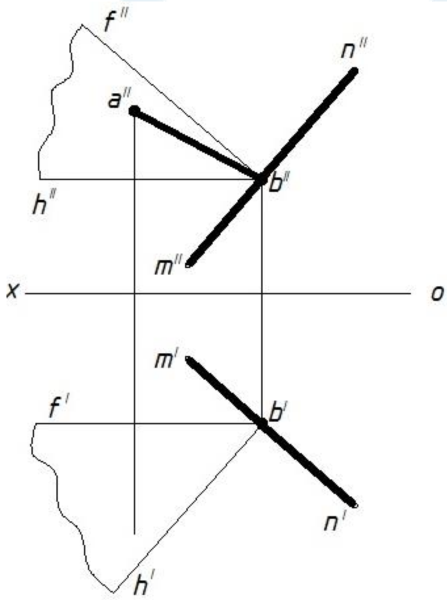

Fig. 12

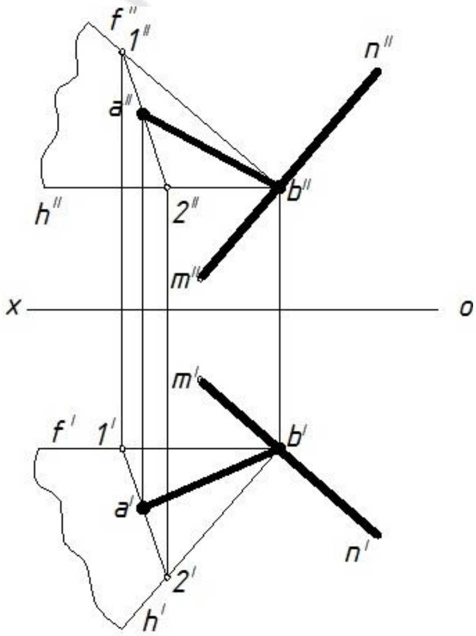

Fig. 13

3. To determine the actual size of the sides of the square, H_1 (h_1, h_1') is rotated around the horizontal rotation axis until it becomes horizontal,

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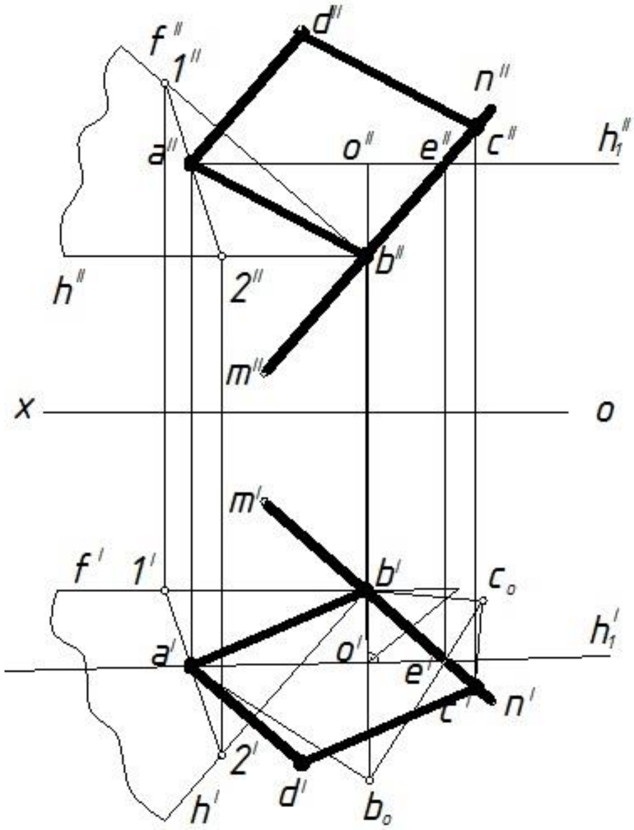
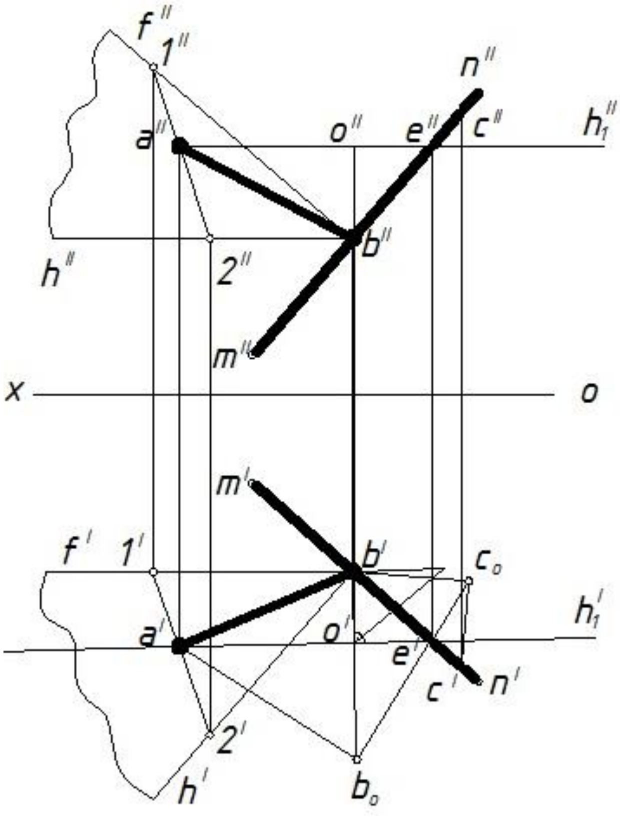
(aB_0e) is determined. In the continuation of B_0e, the size of cross-section aB_0 is measured and C_0 is determined. By backtracking, c is found from C_0. BC(*bc, b′c′*)∩MN(*mn, m′n′*)





4. Since the opposite sides of the square are parallel to each other, CD(*cd, c'd'*)║AB(*ab, a'b'*); DA(*da, d'a'*)║BC(*bc, b'c'*) are respectively parallel straight lines.

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