

METHODOLOGY OF ORGANIZING INTERDISCIPLINARY INTEGRATION ON THE SUBJECT OF TRACES OF A STRAIGHT LINE

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Annotation. In this article, the integration of creating the trace of a straight line with points of intersection with the projection planes in the science of "higher mathematics" and the science of "drawing geometry" and examples of making the trace of a straight line are presented.

Key words: projection, plane, trace of a straight line, integration, horizontal projection, horizontal, frontal, profile trace, horizontal trace of a straight line, frontal trace of a straight line.

1.Introduction

It should be noted that the president paid special attention to mathematics during his visit to research institutes on Olimlar Street of our capital on January 31, 2020.. At the meeting, the need to increase interest in mathematics among young people, the need to properly organize the work of selecting talented children and enrolling them in specialized schools and later higher education institutions, creating popular textbooks and training manuals for students on this subject written in simple and understandable language, instilling mathematical consciousness, if necessary, from kindergarten the task of formation was set.

- Mathematics is the basis of all exact sciences. A child who knows this subject well will grow up to be smart, broad-minded, and work successfully in any field, - said the President.

Graphical geometry is a branch of mathematics that studies the methods of representing geometric bodies in a plane and in space. One of the basic elements of graphic geometry is the trace of a straight line - a point that remains on the surface of an object when it moves along a straight line.

The study of drawing geometry is of great importance for solving problems in mechanics, architecture, mechanical engineering and other fields where work with geometric objects is required.

The study of graphic geometry helps to develop students' spatial thinking, improve the skills of working with graphic images, and improve the quality of problem solving. It should not be forgotten that drawing geometry is not just a theory, but a practical tool used in solving problems and designing various objects in real life. It should not be forgotten that drawing geometry is not just a theory, but a practical tool used in solving problems and designing various objects in real life.

2.Methods. In drawing geometry, the points of intersection of a straight line with projection planes are called traces of a straight line. A straight line in the general position intersects all projection planes. A straight line in a special case has one trace if it is a positioner and two traces if it is a level line.

Straight line traces can be used to determine the direction of motion of an object or to draw straight lines on a plane.. For example, in geodesy, straight-line traces can be used to determine the direction of movement or to construct graphical images that show the location of objects on the ground and other geographic features. In mechanical engineering, straight-line traces can be used to define points of contact between two surfaces, or to draw straight lines to help describe a design and understand how it works.

Point M is a horizontal trace of a straight line, point N is a frontal trace. The horizontal projection of the horizontal trace of the straight line M' coincides with the point M on the trace itself, and the frontal projection of this trace M'' lies on the Ox axis (Fig. 1). The frontal projection N'' of the frontal trace of a straight line corresponds to point N , and the horizontal projection N' lies on the Ox axis.

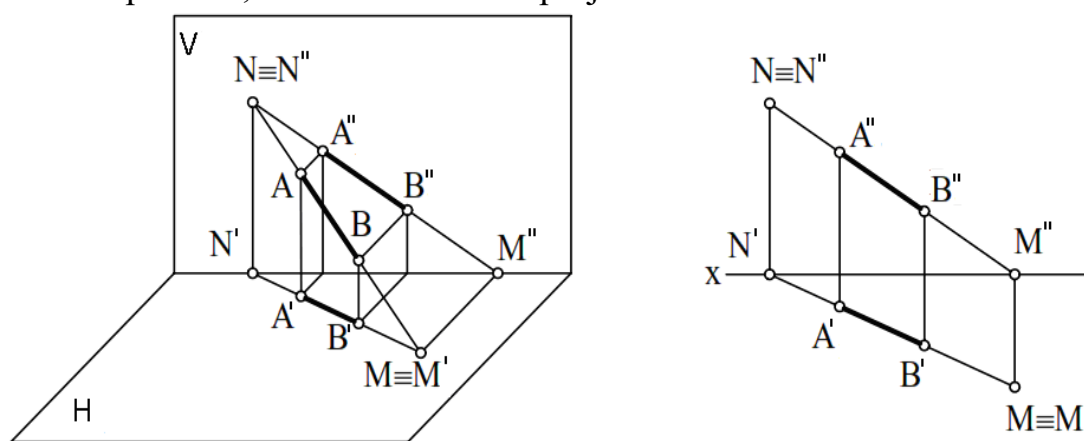


Fig. 1

To construct a horizontal trace M of a straight line, it is necessary to continue the frontal projection of the straight line until it intersects with the Ox axis, and at this point, transfer it perpendicularly until it intersects with the horizontal projection of the straight line.

To construct the frontal trace of a straight line, we continue the horizontal projection of the straight line until it intersects with the Ox axis, and from the point of intersection, we transfer it perpendicular to the axis of the axis until it intersects with the frontal projection of the straight line. In pictures 2-3 with these rules. Traces of straight lines a and b are constructed. To construct the frontal trace of a straight line, we continue the horizontal projection of the straight line until it intersects with the Ox axis, and from the point of intersection, we transfer it perpendicular to the axis of the axis until it intersects with the frontal projection of the straight line. In pictures 2-3 with these rules. Traces of straight lines a and b

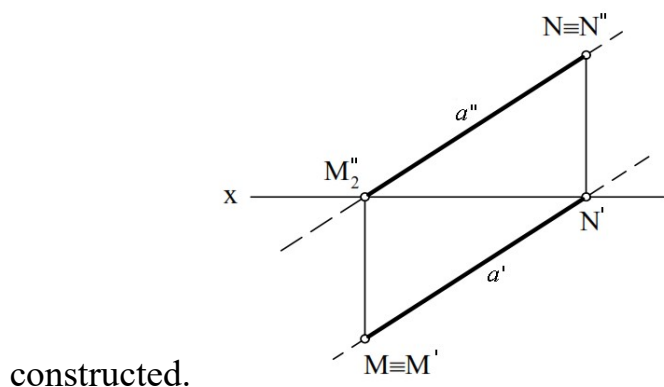


Fig. 2

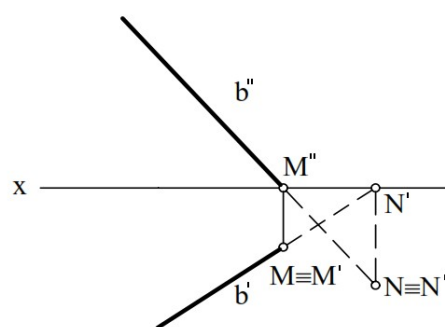


Fig. 3

Since the traces of straight lines are the points where a straight line passes from one quarter to another, they allow us to determine the appearance of this straight line. The part of the straight line inside the first octant is visible. The projections of the visible part of the straight line are represented by main lines, and the invisible ones by dashed lines.

Figure 4 shows the construction of traces of a straight line in a system of three projection planes.

The construction of horizontal and frontal traces is carried out according to the above rules, the profile trace P of a straight line is found as a point of intersection with the plane of profile projections. The profile projection of the straight line profile trace corresponds to the trace itself, the horizontal projection P' of this trace lies on the axis of the Moon; P'' frontal projection lies on the Oz axis. To construct a profile trace of a straight line, we continue the frontal projection of a straight line until it intersects with the Oz axis. We mark the point P'' and from this point we transfer the line perpendicular to the Oz axis until it intersects with the profile projection. This point P''' will be the profile trace of the straight line, which overlaps with P'' . The horizontal projection R' of the profile trace is determined at the point of intersection of the horizontal projection of the straight line with the axis of the Moon (Fig. 5).

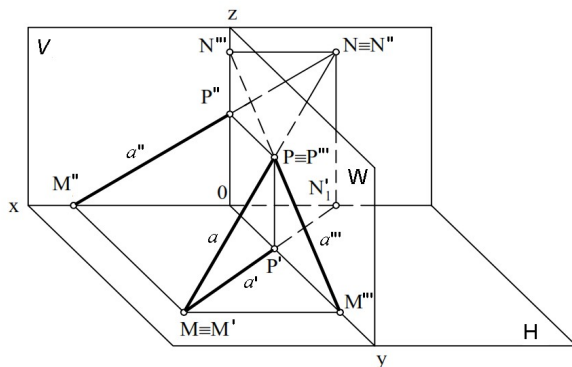


Fig. 4

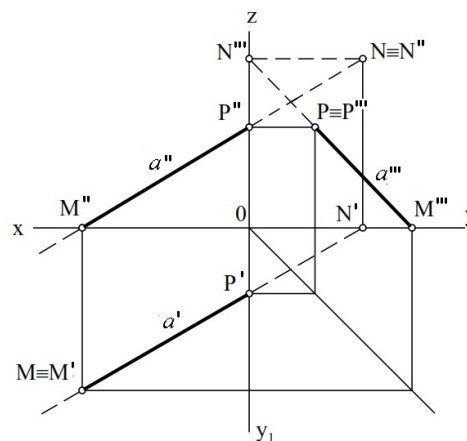


Fig. 5

Finding the horizontal and frontal traces of a given straight line based on the science of higher mathematics. and we determine that the vector according to the coordinates of the points is the direction vector of the straight line, and consider that the straight line passes through the point. Finding the horizontal and frontal traces of a given straight line based on the science of higher mathematics. and we determine that the vector according to the coordinates of the points is the direction vector of the straight line, and consider that the straight line passes through the

point. *AB from the canonical equation of a straight line* $\frac{x-x_1}{x_2-x_1} = \frac{y-y_1}{y_2-y_1} = \frac{z-z_1}{z_2-z_1}$ we

form the general $\begin{cases} (y_2 - y_1)x - (y_2 - y_1)x_1 = (x_2 - x_1)y - (x_2 - x_1)y_1 \\ (z_2 - z_1)x - (z_2 - z_1)x_1 = (x_2 - x_1)z - (x_2 - x_1)z_1 \end{cases}$ *equation of a*

straight line. We determine the point of intersection of the resulting *AB straight line* $oxy (z = 0)$ with the $M_0^1(x_0^1; y_0^1; 0)$ plane, $oxz (y = 0)$ the point of intersection with the plane $M_0^2(x_0^2; 0; z_0^2)$ and $oyz (x = 0)$ the point of intersection with the plane $M_0^3(0; y_0^3; z_0^3)$.

$M_0^1(x_0^1; y_0^1; 0):$

$$\begin{cases} (y_2 - y_1)x - (y_2 - y_1)x_1 = (x_2 - x_1)y - (x_2 - x_1)y_1 \\ (z_2 - z_1)x - (z_2 - z_1)x_1 = (x_2 - x_1)z - (x_2 - x_1)z_1 \\ z = 0 \end{cases}$$

point;

$M_0^2(x_0^2; 0; z_0^2):$

$$\begin{cases} (y_2 - y_1)x - (y_2 - y_1)x_1 = (x_2 - x_1)y - (x_2 - x_1)y_1 \\ (z_2 - z_1)x - (z_2 - z_1)x_1 = (x_2 - x_1)z - (x_2 - x_1)z_1 \\ y = 0 \end{cases}$$

point;

$M_0^3(0; y_0^3; z_0^3):$

$$\begin{cases} (y_2 - y_1)x - (y_2 - y_1)x_1 = (x_2 - x_1)y - (x_2 - x_1)y_1 \\ (z_2 - z_1)x - (z_2 - z_1)x_1 = (x_2 - x_1)z - (x_2 - x_1)z_1 \\ x = 0 \end{cases}$$

$M_0^3(0; 12,5; 70)$ point. *AB the horizontal trace of a straight line* is $oxy (z = 0)$ the point of intersection $M_0^1(70; 48,75; 0)$ with the plane, and the frontal trace $oxz (y = 0)$ is the point of intersection $M_0^2(14,28; 0; 55,71)$ with the plane.

3. Results and Discussion

Issue 1. $A(60;40;10)$ and $B(20;5;50)$ construct the horizontal and frontal traces of the given straight line AB through the coordinates of the points.

Solving. The first method is to construct the horizontal and frontal traces of the given straight line AB based on drawing geometry. According to the rules mentioned above, we construct the horizontal and frontal traces of the straight line AB. After finding the traces, we measure the coordinates of their projections and determine the following: horizontal trace point, $N(x = 70; y = 48,75; z = 0)$ frontal trace point, $M(x = 14,28; y = 0; z = 55,71)$ (Fig. 6).

The second method is to find the horizontal and frontal traces of a given straight line based on the science of higher mathematics. $A(60;40;10)$ and $B(20;5;50)$ we determine the vector according to the coordinates of $\overrightarrow{AB} = \{-40; -35; 40\}$ of the points. $M_0(x_0; y_0; z_0)$ as $B(20;5;50)$ taking point coordinates AB from the canonical equation of a straight line $\frac{x-20}{-40} = \frac{y-5}{-35} = \frac{z-50}{40}$ AB we derive the general equation of $\begin{cases} x+z-70=0 \\ 7x-8y-100=0 \end{cases}$ a straight line. The resulting AB straight line AB the point of intersection of, $oxy (z=0)$ a straight line $M_0^1(x_0^1; y_0^1; 0)$ with a plane, $oxz (y=0)$, $M_0^2(x_0^2; 0; z_0^2)$ and $oyz (x=0)$ we determine the point of $M_0^3(0; y_0^3; z_0^3)$ intersection with the plane.

$M_0^1(x_0^1; y_0^1; 0): \begin{cases} x+z-70=0 \\ 7x-8y-100=0 \\ z=0 \end{cases} \rightarrow \begin{cases} x-70=0 \\ 7x-8y-100=0 \end{cases} \rightarrow \begin{cases} x=70 \\ y=48,75 \end{cases} M_0^1(70; 48,75; 0) \text{ point;}$
 $M_0^2(x_0^2; 0; z_0^2): \begin{cases} x+z-70=0 \\ 7x-8y-100=0 \\ y=0 \end{cases} \rightarrow \begin{cases} x+z-70=0 \\ 7x-100=0 \end{cases} \rightarrow \begin{cases} x=14,28 \\ z=55,71 \end{cases} M_0^2(14,28; 0; 55,71) \text{ point;}$
 $M_0^3(0; y_0^3; z_0^3): \begin{cases} x+z-70=0 \\ 7x-8y-100=0 \\ x=0 \end{cases} \rightarrow \begin{cases} z-70=0 \\ -8y-100=0 \end{cases} \rightarrow \begin{cases} z=70 \\ y=12,5 \end{cases} M_0^3(0; 12,5; 70) \text{ point.}$ AB the horizontal trace of a straight line oxy ($z=0$) is the point of intersection with the plane, $M_0^1(70; 48,75; 0)$ is the point of intersection with the plane, and frontal trace is $oxz (y=0)$ the point of intersection $M_0^2(14,28; 0; 55,71)$ with the plane (Fig. 7).

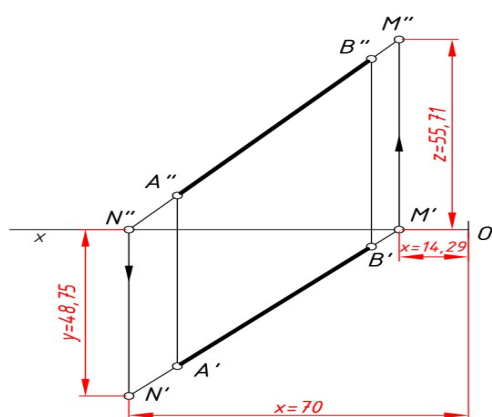


Fig. 6

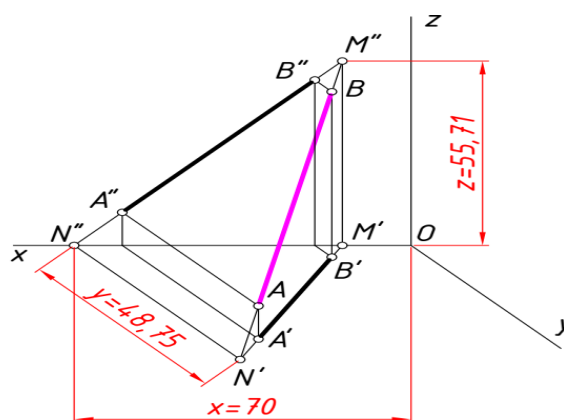


Fig. 7

Issue 2 $C(70;-30;10)$ and $D(20;15;40)$ construct the horizontal and frontal traces of the given straight line CD through the coordinates of the points.[20, 21, 22, 23]

Solving. The first method is to construct the horizontal and frontal traces of the given straight line AB based on drawing geometry. Since point C is located in the second octant, the horizontal trace of the straight line is located in the second octant (Fig. 7). To construct a horizontal trace of a straight line, we continue its frontal projection until it intersects with the Ox axis, and from the point of intersection, a line perpendicular to the Ox axis continues until it intersects with the horizontal projection of the straight line. The MD part of the straight line is visible because it is located in the first octant. To construct the frontalization of a straight line, we draw a perpendicular above the point where the horizontal projection of the straight line intersects with the axis Ox. The intersection of this perpendicular with the frontal projection of the straight line will be the point M of the frontal trace. After finding the traces, we measure the coordinates of their projections and determine the following: horizontal and $N(x = 86,67; y = -45; z = 0)$, frontal trace $M(x = 36,67; y = 0; z = 30)$ point (Fig. 8).[24]

The second method is to find the horizontal and frontal traces of a given straight line based on the science of higher mathematics. $C(70;-30;10)$ and $D(20;15;40)$ we determine the vector according to $\overrightarrow{CD} = \{-50;45;30\}$ the coordinates of the points. $M_0(x_0; y_0; z_0)$ and $D(20;15;40)$ taking the coordinates of the point as CD we form the canonical equation of a straight line $\frac{x-20}{-50} = \frac{y-15}{45} = \frac{z-40}{30}$ or $\frac{x-20}{-10} = \frac{y-15}{9} = \frac{z-40}{6}$ from AB the general equation of a straight line from $\begin{cases} 9x + 10y - 330 = 0 \\ 3x + 5z - 260 = 0 \end{cases}$. According to AB straight line $oxy (z = 0)$ point of intersection $M_0^1(x_0^1; y_0^1; 0)$ with the plane, $oxz (y = 0)$ we determine the point of intersection with the plane $M_0^2(x_0^2; 0; z_0^2)$ and $oyz (x = 0)$ the point of intersection with the plane. $M_0^3(0; y_0^3; z_0^3)$.

$M_0^1(x_0^1; y_0^1; 0)$: $M_0^1(86,66;-45;0)$ point;
 $M_0^2(x_0^2; 0; z_0^2)$: $M_0^2(36,66; 0; 52)$ point;
 $M_0^3(0; y_0^3; z_0^3)$: $M_0^3(0; 33; 52)$ point. AB the horizontal trace of a straight line is $oxy (z = 0)$ the point of intersection $M_0^1(86,66;-45;0)$ with the plane, and the frontal trace is $oxz (y = 0)$ the point of intersection with $M_0^2(36,66; 0; 52)$ the plane (Fig. 9).

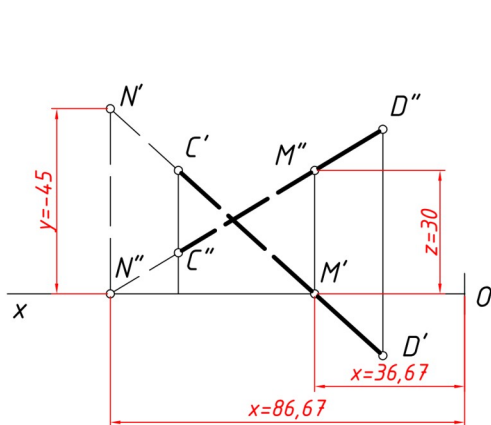


Fig. 8

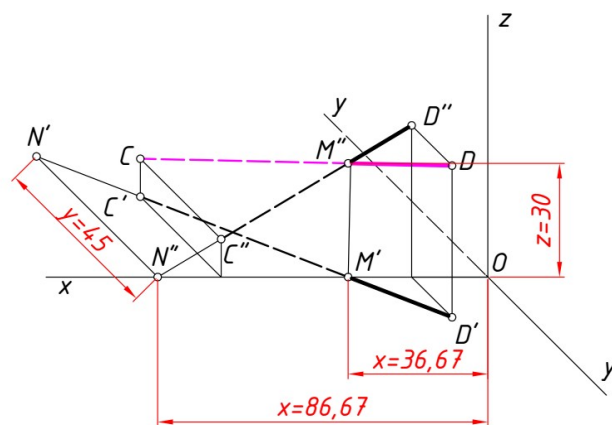


Fig. 9

4 Conclusions

When solving the given two problems, the following conclusion is reached.

In the first problem In the first method, *AB* the horizontal trace of the straight line is $N(x = 70; y = 48,75; z = 0)$, the frontal trace, $M(x = 14,28; y = 0; z = 55,71)$. In the second method, *AB* the horizontal trace of the straight line is $oxy (z = 0)$ the point of intersection with the plane $M_0^1(70; 48,75; 0)$, and the frontal trace is $oxz (y = 0)$ the point of intersection $M_0^2(14,28; 0; 55,71)$ with the plane.

In the second problem In the first method, *CD* horizontal trace of a straight line, horizontal trace $N(x = 86,67; y = -45; z = 0)$, frontal trace $M(x = 36,67; y = 0; z = 30)$. In the second method, *AB* horizontal trace of a straight line, $oxy (z = 0)$ if there is a point of intersection with the plane $M_0^1(86,66; -45; 0)$, frontal trace $oxz (y = 0)$ is the point of intersection $M_0^2(36,66; 0; 52)$ with the plane.

Drawing geometry is a branch of mathematics that studies the methods of making geometric shapes and solving problems using drawings on a plane. This section of mathematics is an important component of education received at a higher educational institution.

The organization of integrated education with the science of higher mathematics in the teaching of drawing geometry at a higher educational institution helps to better understand the basic concepts and principles of drawing geometry, as well as to develop the skills of using the theoretical concepts of the science of "Higher Mathematics" in the development of problem-solving skills using plane drawings.

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