V.N. Karimova

DESCRIPTIVE GEOMETRY

AND ENGINEERING GRAPHICS

MINISTRY OF HIGHER AND SPECIAL EDUCATION OF
REPUBLIK UZBEKISTAN

V.N. Karimova

DESCRIPTIVE GEOMETRY AND ENGINEERING GRAPHICS

Recommended by the Ministry of Higher and Secondary
Special Education as a manual

Publishers «NOSHIR»
Toshkent – 2019

UO'K: 514.18(075.8)
LBC: 22.151.3ya73
K 21

V.N. Karimova.
Descriptive geometry and engineering graphics, collection of practical lessons. Manual for technical high schools. Tashkent, «NOSHIR» 2019, 184 pages.

In the manual the collection of practical tasks are given in Russian. The tasks on the themes: a point, a straight line, a plane, two planes, a straight line and a plane, surfaces, crossing of surface with planes, crossing of two surfaces, transformation of drawing, definition of angles as well as written tasks, samplers for Olympiad tests and tasks, for self – instruction are considered in the manual. The manual is intended for students – bachelors of technical higher educational institutions as well as for specialists engaged in descriptive geometry.

Reviews:
Ganixanova M.B. – TSTU head of Department «Foreign languages»
Sobirova D.U. – Associate Professor of Tashkent State Technical University Head of the Department «Descriptive Geometry and Computer Graphics».

Edited by:
Azimov A.T. – Professor of Tashkent State Technical University.

UO'K: 514.18(075.8)
KBK: 22.151.3ya73

ISBN 978-9943-5483-7-4

INTRODUCTION

A course of descriptive geometry and engineering graphics is a technical discipline for bachelors of the technical education direction giving a knowledge necessary for the study of subsequent common engineering and technical disciplines.

Graphic skills are the main condition of technical knowledge mastering – the ability to read drawings and to reflect graphically correct a technical thought on drawings, sketches and diagrams.

The aim of study "Descriptive geometry and engineering graphics" subject is the development and formation of mental spatial thinking abilities of future bachelors of the technical education direction.

The task of descriptive geometry and engineering graphics course is the study of theoretical basis, the acquisition of practical skills on the technique of geometric forms production constructing on the projection plane, carrying out and reading of production drawings, studying the rules, requirements and recommendations of the state standards with a uniform system of design documentation.

This manual is made for hands-on trainings, based on courses of lectures delivered in Uzbek and Russian languages by the teaching staff of the University department "Descriptive geometry an engineering graphics".

The manual provides examples of intermediate control and final creative script, problem solving algorithms, the samples of Olympiad tasks holding in the republic and the tasks for self-education.

The content of manual meets the requirements of current standards of the uniform system of design documentation, corresponds to the program approved by the Ministry of higher and secondary special education of the Republic of Uzbekistan. The author acknowledges the reviewers useful advices and

practical assistance: D.U. Sabirova, the Associate professor, Head of "Descriptive geometry and engineering graphics" Department of Tashkent State Technical University and Nadirova N.A., the senior teacher of Tashkent branch of the Russian State Oil and Gas University named after Gubkin.

Requirements manual and guidelines for the challenges on descriptive geometry

This tutorial is designed to conduct practical exercises on descriptive geometry, presents to students the following requirements:

1. To have a common notebook into a cell and each page plan the solution of two problems;

2. Write the task conditions and to identify graphical task and write an algorithm for each task;

3. The need for precise construction and graphic solutions for each task requires the purchase of the following drawing supplies 300 and 450 - ing triangles, compasses, curves, as well as to the color design tasks have colored pencils: blue, black and red. Blue is drawn graphics conditions, black - solve problems, make out a red answer to the problem;

4. When drawing a graphical environment problems and their solutions in the use of the following types of lines;

a) solid basic outline - **S = 0,5 · 1,4 mm**, - the conditions for drawing graphics tasks, responses, and for the visible contours, lines, intersections, depending on the format of the drawing:

b) dashed linii-**S/2**-dlya invisible parts of the intersection;

c) solid thin line - **S / 3 · S / 2** - for communication lines to solve the problem. The solution of each problem on orthographic descriptive geometry, which allows precise identification and geometric properties of spatial figures, requires students to:

a) spatial representation before the eyes of the provisions and of arrangements in the space of geometric shapes in their orthographic drawing, according to the conditions specified for each task;

b) determine the order of the sequence of tasks in space and its implementation;

a) order the production of the sequence of solving problems on orthographic based solutions in spatial drawing.

To solve the problems of the manual requires knowledge of the theoretical material contained in textbooks and lectures on descriptive geometry and its application in solving the following problems.

1. Determine the life-size segment of the line.

2. Identify traces of straight lines.

3. To hold the plane straight overall situation, as well as horizontal, frontal.

4. Select points on the plane.

5. Through the point to the plane in general position.

6. Draw a horizontal line through and projecting frontal plane.

7. Hold the next plane defined by parallel and intersecting lines.

8. After a point to a plane parallel to a given plane.

9. Construct the intersection of two planes were asked the following

10. Draw a straight line through the points given plane

11. Through a given point to the plane of the line.

12. Determine the point of intersection with the plane.

13. After a point a perpendicular to the plane.

14. After a point to a plane perpendicular to the given line.

15. After a point to a plane perpendicular to a given plane.

16. Determine the full length of the line segment method of rotation.

17. Combine the plane with the plane of projection.

18. Determine the full length of the line segment matching method.

19. Determine the full length of the line segment means a change of the projection planes.

20. Determine the value of the linear angle.

21. Selecting a point on the surface of the polyhedron, and surfaces of revolution.

22. Construct the point of intersection with the surface.

23. Build a line of intersection of the planes with the surface.

24. Construct the intersection of two surfaces.

SUBJECT: POINT

Standards of ESKD. GOST 2.301-96; Formats of drawings

The State standards **R.Uz.2-301-96** set of drawing sheets formats and other documents which are specified for the design documentation standards for all branches of industry and construction.

The sheets formats are determined by the dimensions of the outer frame.

A format **A0** size **1189x841** mm which has the area equal to **1m^2** and other formats obtained by the consecutive division of it into two equal parts parallel to the smaller side of the appropriate size are taken as the main.

Denominations and sizes of main formats should conform to the shown ones in the **Table 1.**

If it is necessary it is allowed to use A5 format with the sides **148x214 mm.**

Table № 1

Denomination of format	A0	A1	A2	A3	A4
Sizes of the format sides, mm	1189x841	594x841	594x420	297x420	297x210

Format A4 is located only vertically, the format larger than **A4** is located in any convenient position for working. In all formats of drawings the frame lines are drawn on the left side of the frame from the edge of paper at a distance of **20 mm** from the format's border for drawings stitching, form the other three sides – **5 mm** (Fig.1)

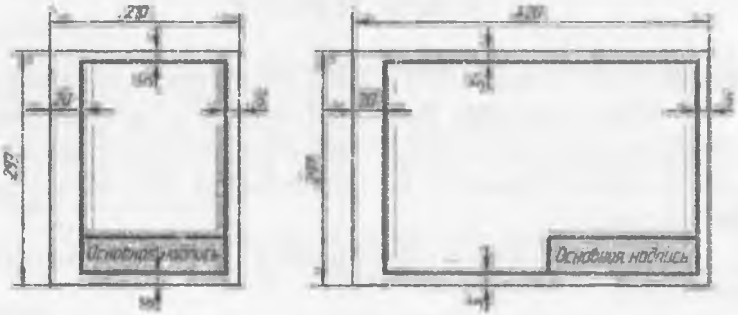


Fig.1.

MAIN CAPTION OF A DRAWING

In the lower right corner of the drawing on the frame line the main caption of a drawing divided into columns of the defined sizes is carried out.

The main caption of a drawing should contain basic information about the drawing. Forms, sizes and content of the main caption are identified by the State standard **2.104-97RUz**.

For the main captions of drawings and schemes the Form **1** is applied (Fig.2).

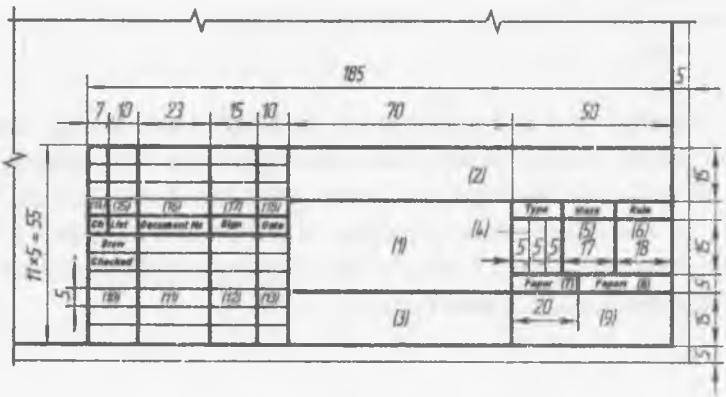


Fig 2.

In the columns of the main caption are indicated:

In the column 1 – name of an item as well as the name of a document, if the document is assigned with a code;

In the column 2 – denomination of the document;

In the column 3 – denomination of the detail's material;

In the column 4 – a drawing letter (for teaching drawing is a sign У);

In the column 5 – the weight of item in kilograms, without indicating of the unit measure;

In the column 6 – the scale (marked in accordance with **GOST 2.302.-97**);

In the column 7 – the serial number of the sheet (not filled in the educational institutions);

In column 8 – the total number of the document sheets;

In the column 9 – name of the company, issuing the document (the educational institution name and code of the group);

In the column 10 – the nature of the work performed by a person who signed the document;

In the column 11 – the first name of persons who signed the document;

In the column 12 – signatures of persons whose first names indicated in the column 11;

In the column 13 – the date of the document signing; the columns 3 and 5 are filled only in the drawings of details.

SUBJECT: POINT

In the columns of the main caption are indicated:

In the column 1 – name of an item as well as the name of a document, if the document is assigned with a code;

In the column 2 – denomination of the document;

In the column 3 – denomination of the detail's material;

In the column 4 – a drawing letter (for teaching drawing is a sign У);

In the column 5 – the weight of item in kilograms, without indicating of the unit measure;

In the column 6 – the scale (marked in accordance with **GOST 2.302.-97**);

In the column 7 – the serial number of the sheet (not filled in the educational institutions);

In column 8 – the total number of the document sheets;

In the column 9 – name of the company, issuing the document (the educational institution name and code of the group);

In the column 10 – the nature of the work performed by a person who signed the document;

In the column 11 – the first name of persons who signed the document;

In the column 12 – signatures of persons whose first names indicated in the column 11;

In the column 13 – the date of the document signing; the columns 3 and 5 are filled only in the drawings of details.

LINES

The drawings of all branches of industry and construction are carried out with the lines specified by State Standard **2.303-97RUz.**

In the columns of the main caption are indicated:

In the column 1 – name of an item as well as the name of a document, if the document is assigned with a code;

In the column 2 – denomination of the document;

In the column 3 – denomination of the detail's material;

In the column 4 – a drawing letter (for teaching drawing is a sign У);

In the column 5 – the weight of item in kilograms, without indicating of the unit measure;

In the column 6 – the scale (marked in accordance with **GOST 2.302.-97**);

In the column 7 – the serial number of the sheet (not filled in the educational institutions);

In column 8 – the total number of the document sheets;

In the column 9 – name of the company, issuing the document (the educational institution name and code of the group);

In the column 10 – the nature of the work performed by a person who signed the document;

In the column 11 – the first name of persons who signed the document;

In the column 12 – signatures of persons whose first names indicated in the column 11;

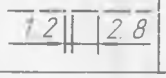
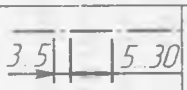
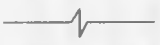
In the column 13 – the date of the document signing; the columns 3 and 5 are filled only in the drawings of details.

LINES

The drawings of all branches of industry and construction are carried out with the lines specified by State Standard **2.303-97RUz.**

Denomination, tracing, line thickness to the thickness of the main line and the main purposes of lines should correspond to the mentioned ones in the table 2.

Table № 2.

№	Name	Tracing	Line thickness to the thickness of base line S	Main purpose
1	Solid thick line		s=0,5÷1,4mm	Line of visible outline break line visible lines of outline section (offset and entering into compound of sectional arrangement)
2	Solid thin line		$\frac{S}{3} \div \frac{S}{2}$	Outline lines of revolved section. Dimension lines and extension lines of hatching. Ledges of lines – leaders and underlining of inscriptions. Lines for images of boundary details ("situation"). Lines of limitation of the extensions
3	Solid wavy line		$\frac{S}{3} \div \frac{S}{2}$	Lines of separation Line of differentiation of view and cut
4	Dashed line		$\frac{S}{3} \div \frac{S}{2}$	Lines of hidden outline Break lines hidden
5	Thin dash-dotted line		$\frac{S}{3} \div \frac{S}{2}$	Center and axial lines Lines of sections being the axes of symmetry for superimposed or offset sections
6	Thick dash-dotted line		$\frac{S}{2} \div \frac{2}{3}S$	Lines indicating the surfaces for thermal treatment or covering Lines for imaging the elements located before thee secant plane (superimposed projection)
7	Open-ended line		$S \div 1\frac{1}{2}S$	Lines of section
8	Solid line with kink		$\frac{S}{3} \div \frac{S}{2}$	Long break lines
9	Thin dash-dotted line with two points		$\frac{S}{3} \div \frac{S}{2}$	Bend lines on lofts Lines for loft representation superposed with view

Examples of lines using are shown in fig. 5.

The main solid thick line thickness **S** should be within **0.6** to **1.4 mm** depending of image size and complexity, as well as of the drawing format.

The thickness of the same type lines should be identical for all images in the current drawing that draw TB in identical scale. Dashes of the lines should be of the equal length and spaces between them should be identical.

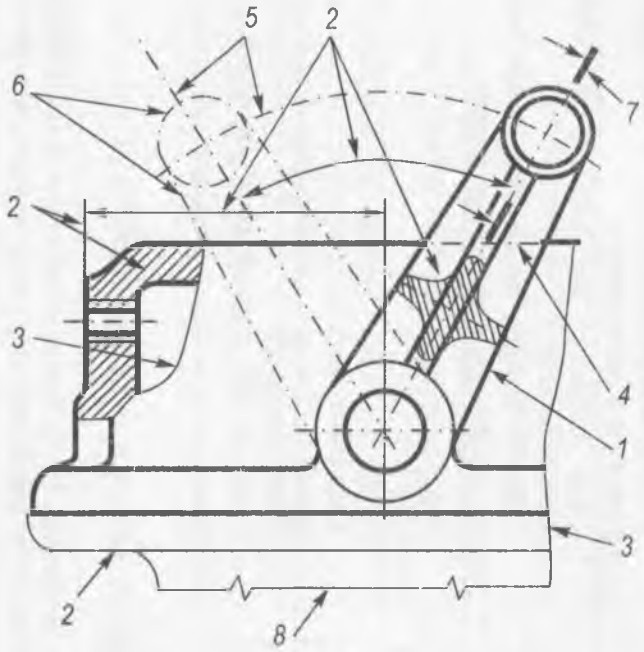


Fig. 5.

The dash-dotted lines should be crossed and ended with the dashes. The center lines should escape the circle contours on **3...5 mm (fig.6, a),** for the circles, which diameter **is 12 mm** and less, the center lines are drawn with solid thin lines **(fig.6, b).**

All structures on the drawings are carried out with thin lines in pencil. The drawing is outlined with a pencil after the careful checking.

The outlining of drawing begins from the lines which have the least thickness. The axes, gauge curves are outlined in the

first place, then the circular arcs and after all the straight lines are outlined.

The execution of drawing is finished with the extension lines, making of sizes and other explaining signs or designations.

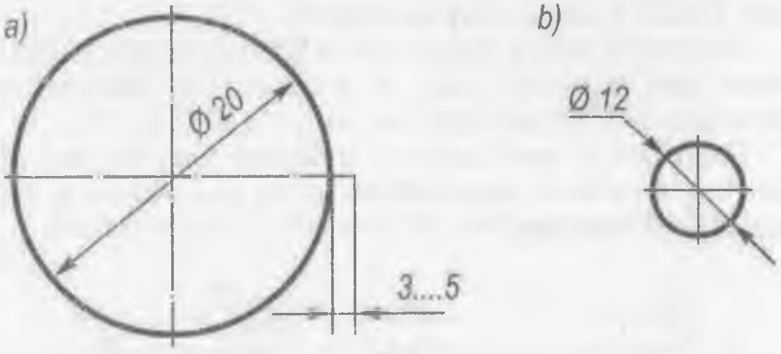


Fig. 6

LESSON № 2

DRAWING FONTS

All inscriptions and sizes drawn on the drawings and other documentations of all branches of industry and construction, are carried out with a standard font according to the State standard **2.304-97RUz.** The standard fixes the following font sizes: **(1b): 2,5;3,5;5;7;10;14;20;28;40;**

The size of font **h** defines the height of the title (initial) letters and numerals, and is measured in millimeters perpendicular to the bottom of line.

The height of small letters **C** is defined from the ratio of their height (without outgrowth **K**) to the size of font **h,** for example **c=7/10h, (fig.7)**

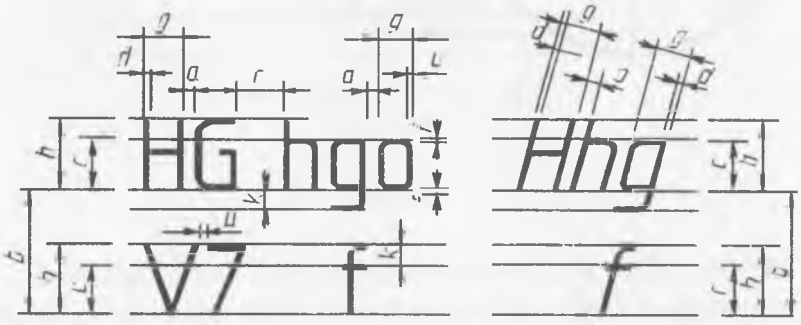


Fig.7

The width of font q-maximal width of font is defined to font size **h**, for example q=**6/10h**, or to font line thickness, for example q=**6d** (fig. 7)

The thickness of font **d** is defined with the type and height of font.

The auxiliary net is formed by auxiliary lines in which the fonts are written. The step of auxiliary net's lines is defined from the font thickness **d** (fig. 8).

DESIGN OF DRAWINGS

The step of auxiliary net's lines is defined from the font thickness **d** (fig. 8).

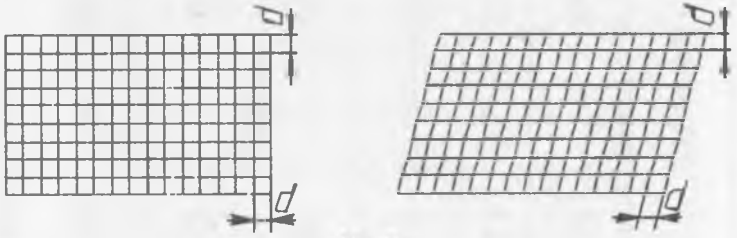


Fig.8

Font structuring in the auxiliary net is shown (fig. 9).

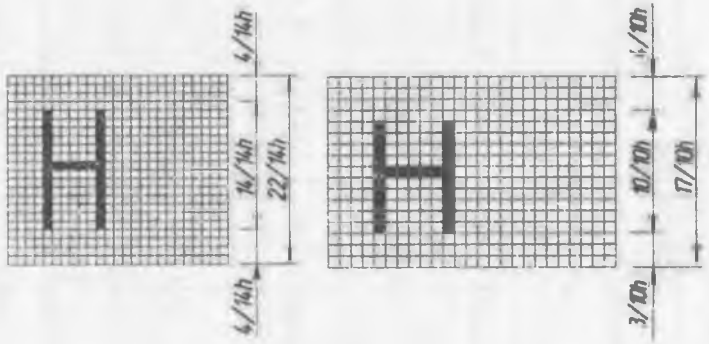


Fig.9

The following font types are fixed:

Type A with a slope of a lettering about **75 °(d=h/14). (Table 2).**

Table№2.

Font characteristics	Denominations	Relative size		Sizes, mm					
Font size – height of title letters	H	(14/14) h	14d	3,5	5,0	7,0	10,0	14,0	20,0
Height of small letters	c	(10/14) h	10d	2,5	3,5	5,0	7,0	10,0	14,0
Distance between the letters	α	(2/14) h	2d	0,5	0,7	1,0	1,4	2,0	2,8
Minimal step of lines (height of auxiliary net)	b	(22/14) h	22d	5,5	8,0	11,0	16,0	22,0	31,0
Minimal distance between the words	e	(6/14) h	6d	1,5	2,1	3,1	4,2	6,0	8,4
Thickness of font lines	d	(1/14) h	d	0,25	0,35	0,5	0,7	1,0	1,4

DESIGN OF DRAWINGS / DESIGN OF DRAWINGS

Type B with a slope of a lettering about **75° (d=h/10)**

Table№ 3

Font characteristics	Denominations	Relative size		Sizes, mm					
Font size – height of title letters	h	(10/10) h	10d	2,5	3,0	5,0	7,0	10,0	14,0 20,0
Height of small letters	c	(7/10) h	7d	2,5	3,5	5,0	7,0	10,0	10,0 14,0
Distance between the letters	α	(2/10) h	2d	0,5	0,7	1,0	1,4	2,0	4,0 2,8
Minimal step of lines (height of auxiliary net)	b	(17/10) h	17d	5,5	8,0	11,0	16,0	22,0	24,0 31,0
Minimal distance between the words	e	(6/10) h	6d	1,5	2,1	3,1	4,2	6,0	12,08, 4
Thickness of font lines	d	(1/10) h	d	0,25	0,35	0,5	0,7	1,0	2,0 1,4

Notes:

1. The interval **d** between letters which main lines are not parallel between each other (for example, **GA, AT**), may be half decreased, that is to the thickness **d** of font line.

2. The minimal interval between words **e**, divided with the punctuation mark is the interval between the punctuation mark and the word which follows it.

DESIGN OF DRAWINGS

Type A with a slope of a lettering about **75°** **(d=h/14)** given in **fig. 10**

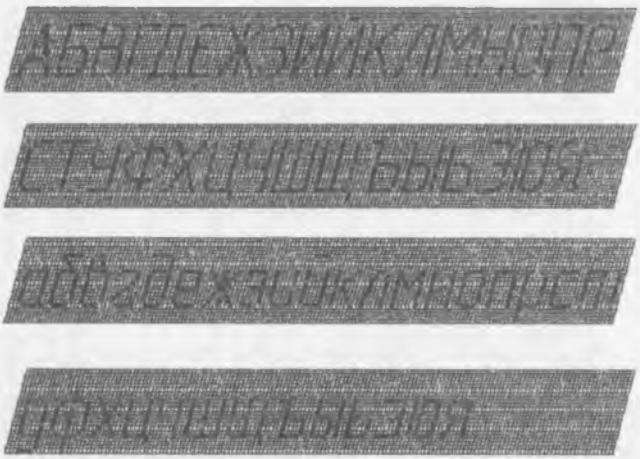


Fig.10

Type A without a slope of a lettering given in **fig. 11.**

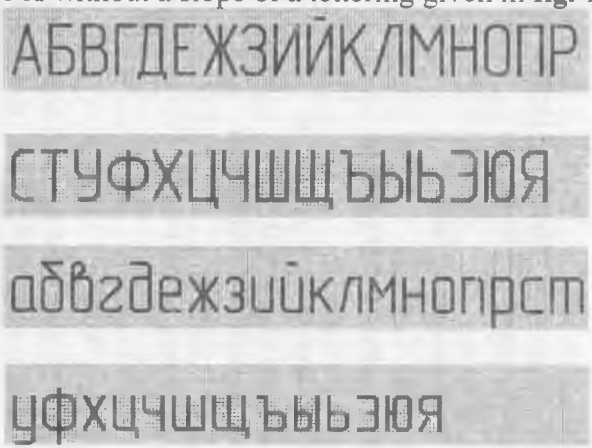


Fig.11

DESIGN OF DRAWINGS

Type B with a slope of a lettering **75° (d=h/10)** given in **fig.12.**

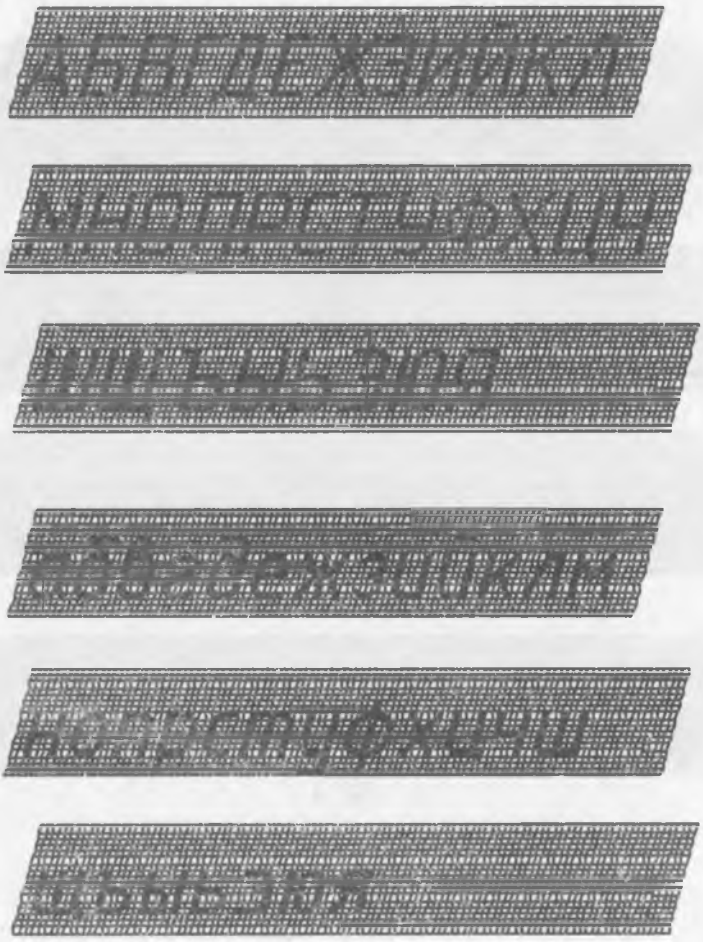


Fig.12

Latin alphabet type **A** with a slope of a lettering **75°** **(fig.13)**

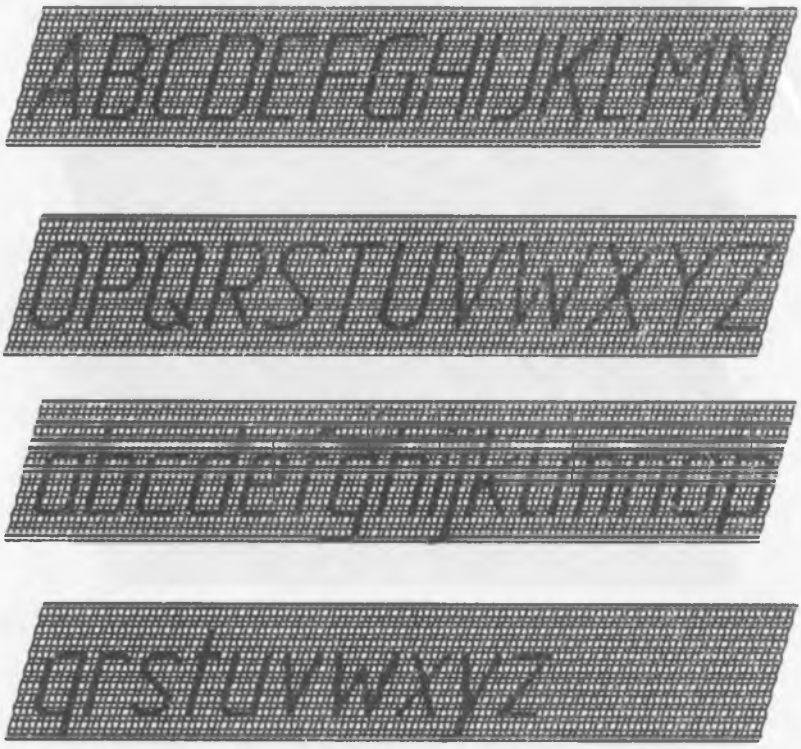


Fig.13

DESIGN OF DRAWINGS

Latin alphabet of type **B** with a slope of a lettering **75°** **(fig.14)**

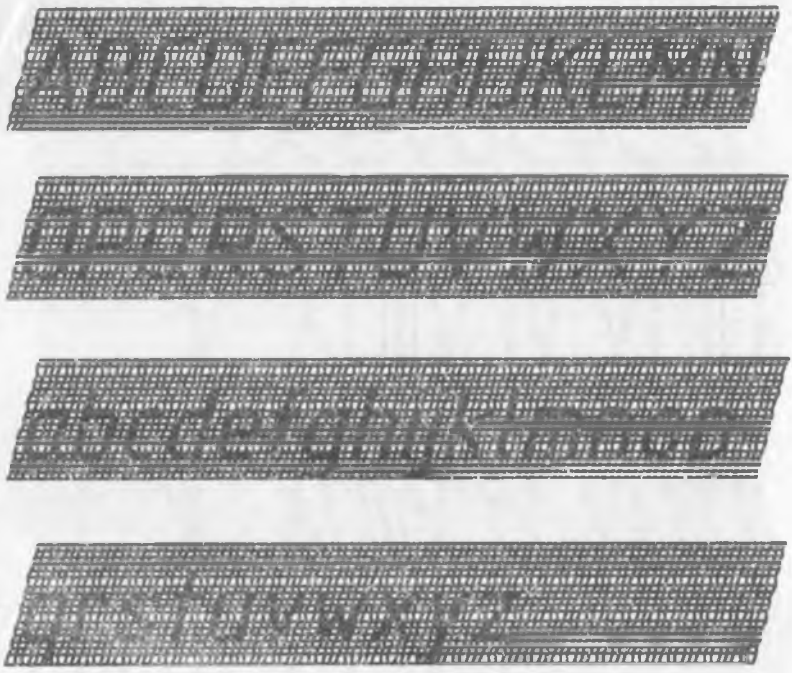


Fig14

Arabic and roman numerals of **type A** with a slope of a lettering **75°** **(fig.15)**

Fig.15

Arabic and roman numerals of **type B** without a slope of a lettering **fig.16)**

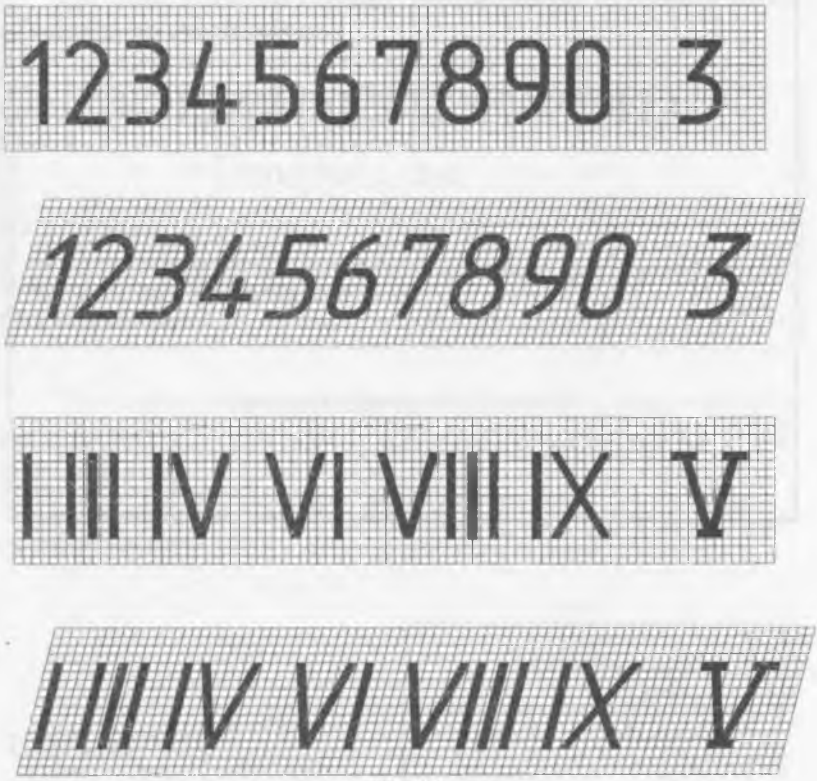


Fig.16

Execution of the title page

TSTU

Department of "Descriptive geometry
and engineering graphics"

ALBUM OF THE DRAWINGS

Code 30-14 OGF
Performed by Sabirov M.

2014-2015 academic year

DESIGN OF DRAWINGS

SCALES

A scale is the ratio of the represented object's linear dimensions in the drawing to its real sizes.

The State standard **2.302-97RUz** fixes the following scales of images on the drawings.

Reduction scales	1:2:1:2.5;1:4;1:5;1:10;1:20;1;25;1:40;1:75;1:100;1:200;1:400; 1:500;1:800;1:1000
Natural size	1:1
Scales of magnification	2:1;2,5:1;4:1;5:1;10:1;2,0:1;40:1;50:1;100:1

The scale in the main caption of drawing is determined by the type 1:1; 1:2; 2:1; etc., in other cases by the type M 1:1, M 1: 2, M 2:1 etc.

Independently from the scale only actual sizes are made on the drawing (fig. 17).

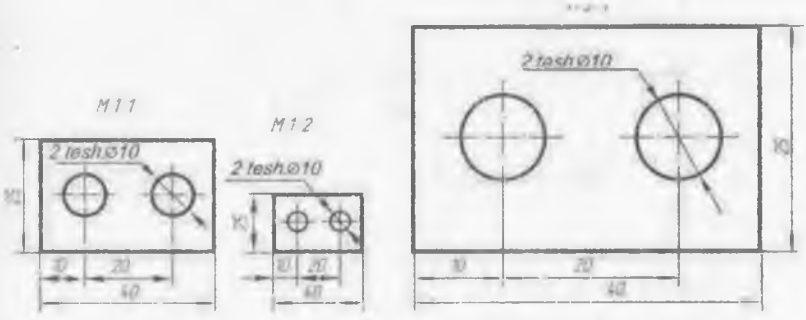
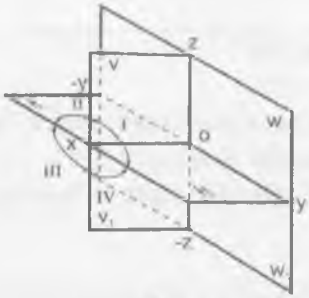
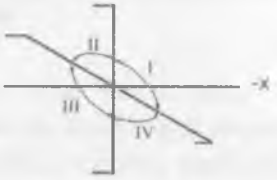
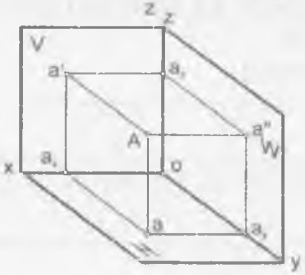


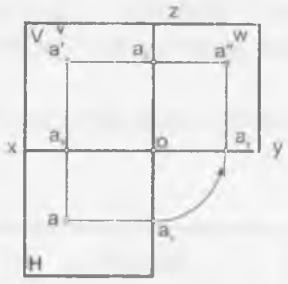
fig. 17

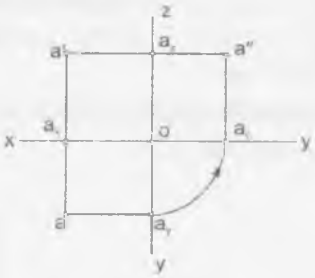
LESSON №3









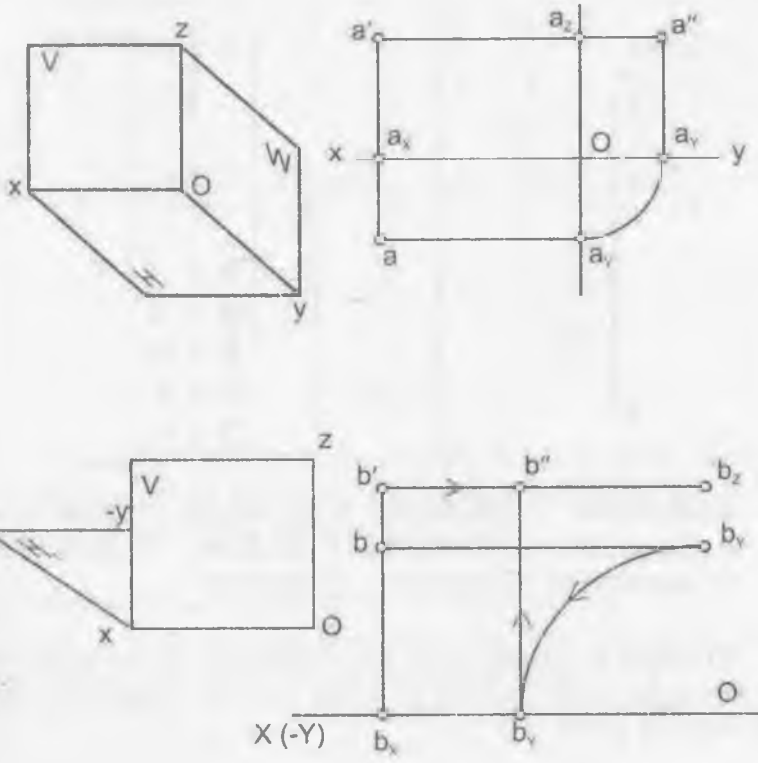


a - A′
a′ - A″
a″ - A‴

$|AH|=|Aa|=|a'a_x|=Z_A$
$|AV|=|Aa'|=|aa_x|=Y_A$
$|AW|=|Aa''|=|a'a_x|=X_A$

SUBJECT: POINT.

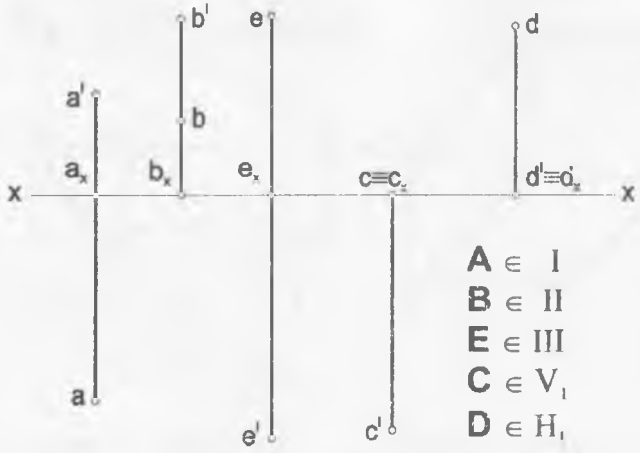
Example 1. According to the coordinates of each point of the image build octant in which they are flat and orthogonal to the drawing points.



A (50;20;35) *B (60;-30;40)*

SUBJECT: POINT.

Example 2. The images points on the orthographic determine in which quadrant is each point. Answers of written symbols.

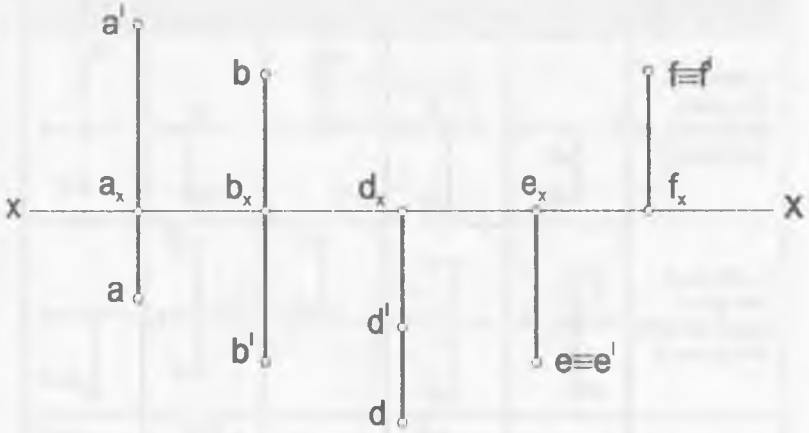


A (40;20;30) D (40;50;60) S (50;-50;50) M (0;0;20)
B (40;-60;30) E (40;40;40) P (40;0;50) N (0;50;0)
C (40;-20;-50) F (50;30;0) Q (30;0;0)

Example 3. According to the coordinates of the points to construct the image octants in which they are located and the flat drawing points.

SUBJECT: POINT.

Example 4. The image points on the orthographic determine which corner of the space is every point. Answers written symbols.



Example 5. To determine which point is closer to the front of the projection plane V, which point is located above the projections above the horizontal plane H.

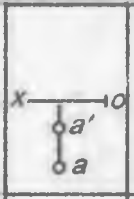
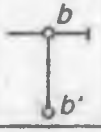
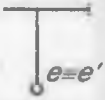
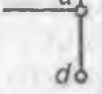
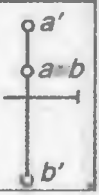
Example 6. Given Point A (40, 30, 40) build

a) A = S (v) (B) diagrams the point B, point A is symmetric with respect to the projection plane V;

в) **A=S(н)(C)** d) **A=S[o y)(E)**

c) **A=S[ox)(D)** e) **A=S(o)(F)**

SUBJECT: POINT.

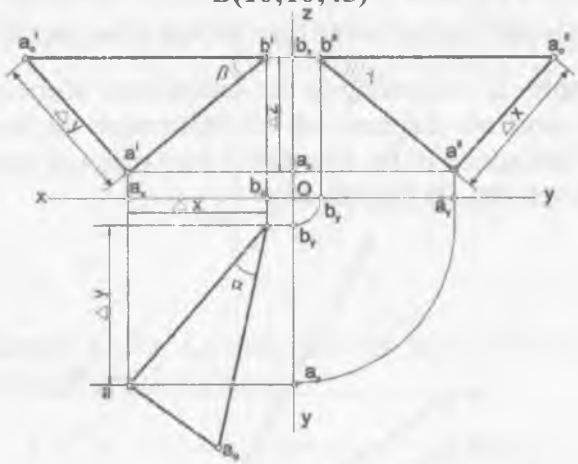
Topic:	Point.			Variant	0
Condition of the Task	Answers				
	1	2	3	4	5
1. Which of the given points lying on the plane H					
1. Which of the given points lying on the plane H					
3, Which of given ponts lying near to plane W					
4. On what drawing is point $\in$[OX)					
5. On what drawing is point $A=S_{(OX)}B$					

LESSON №4

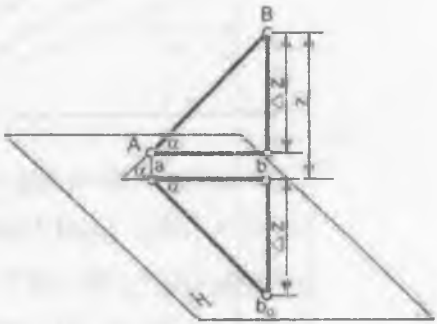
SUBJECT: DIRECT LINE.

Example1. According to the coordinates of the points A and B to construct diagrams of AB, determine the length and angles of inclination of the line AB to each plane of projection.

A(55;60;10)
B(10;10;45)



[AC] ll [ab]
|AC| = |ab|
[AB] ^ H = α
[AB] ^ [AC] = α
[ab] ^ [bb$_o$] = 90^0
|ab$_o$|= |AB|
[ab] ^ [ab$_o$] = α



$\Delta Z = |Bb| - |Aa| = |BX| = B_z - A_z$

SUBJECT: DIRECT LINE.

$\Delta Z = |b'b_x| - |a'a_x| = |b'c'| = b_z - a_z = 45 - 10 = 30$

$\Delta Y = |aa_x| - |bb_x| = |aa'| = a_y - b_y = 60 - 10 = 50$

$\Delta X = |a'a_z| - |b'b_z| = |a'c'| = a_x - b_x = 55 - 10 = 45$

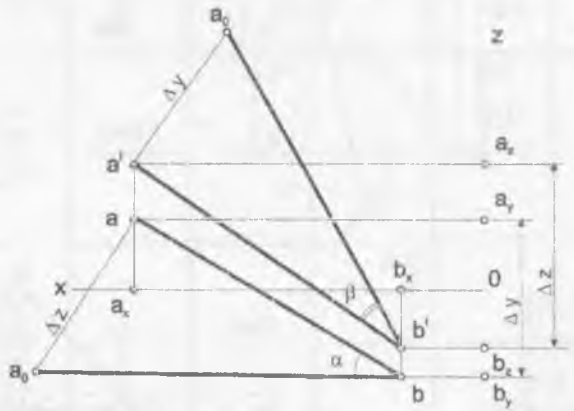
$|aa_0| = |\Delta Z|$; $|a_0b| = |AB|$; $[a_0b] \wedge [ab] = \alpha$; $\alpha = (AB) \wedge H$

$|a'a'_0| = |\Delta Y|$; $|a'_0b'| = |AB|$; $[a'_0b'] \wedge [a'b'] = \beta$; $\beta = (AB) \wedge V$

$|a''a''_0| = |\Delta X|$; $|a''_0b''| = |AB|$; $[a''_0b''] \wedge [a''b''] = \gamma$; $\gamma = (AB) \wedge W$

Example 2. According to the coordinates of the points A and B to construct diagrams of AB, determine the length and angles of inclination of the line AB to each plane of projection.

A (70;-20;40), B (20;30;-20)



$\Delta X = a_z - b_z = 40 - (-20) = 60$

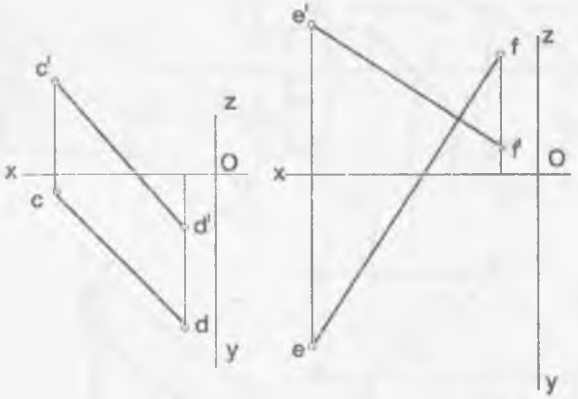
$|a_0b| = |AB|$; $[a_0b] \wedge [ab] = \alpha$; $\alpha = (AB) \wedge H$

$\Delta Y = a_y - b_y = -40 - 30 = -50$

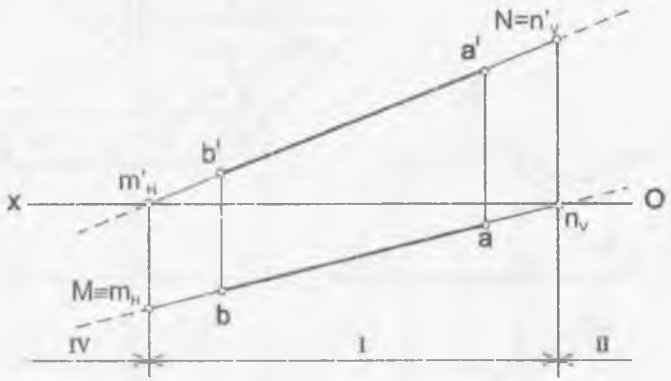
$|a'_0b'| = |AB|$; $[a'_0b'] \wedge [a'b'] = \beta$; $\beta = (AB) \wedge V$

SUBJECT: DIRECT LINE.

3. A (70;10;40), B (20;50;-20) **4. A (70;30;40), B (30;-10;20)** **5. A (60;-30;50), B (10;-60;10)**

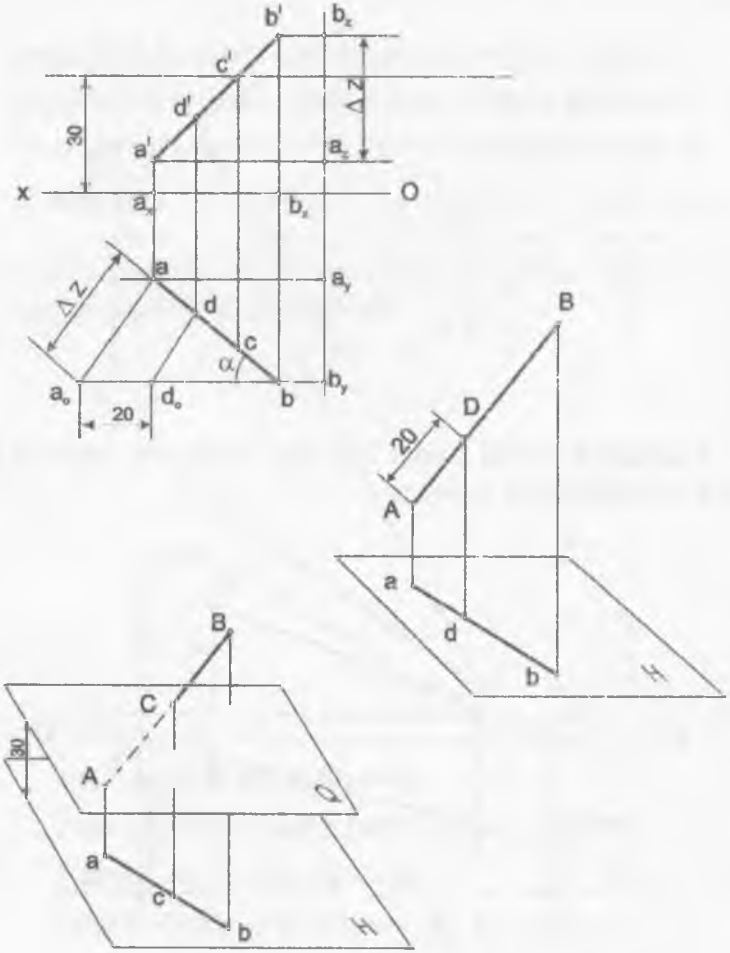


Example 6. Build a trace line and specify the angle of the space through which it passes.

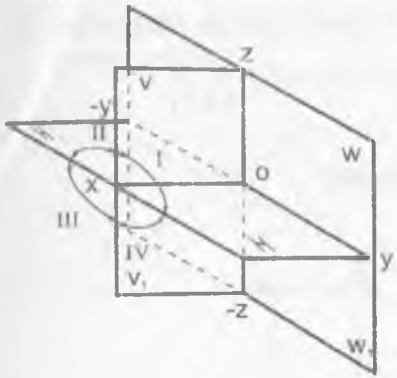


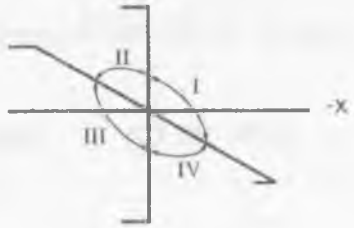
SUBJECT: DIRECT LINE.

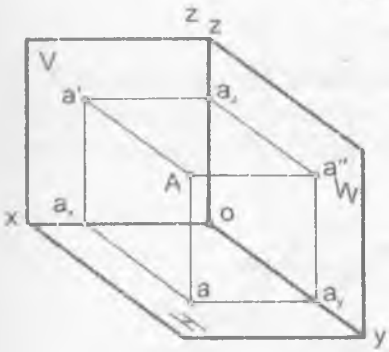
Example 7. On the line AB to construct a point C, remote from the plane H by 30 mm and the point D, remote from point A to 20 mm

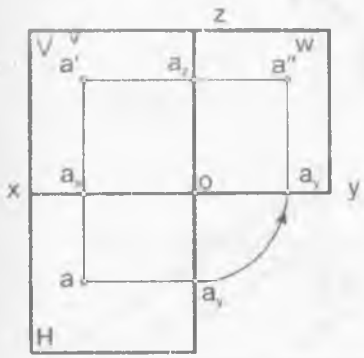


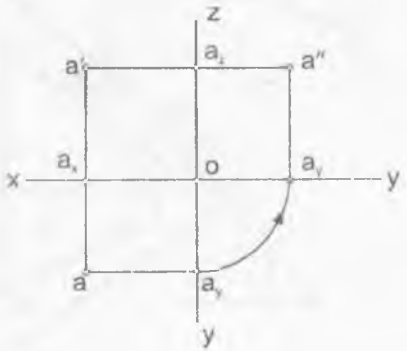
Subject: Point. S
Exercise №3







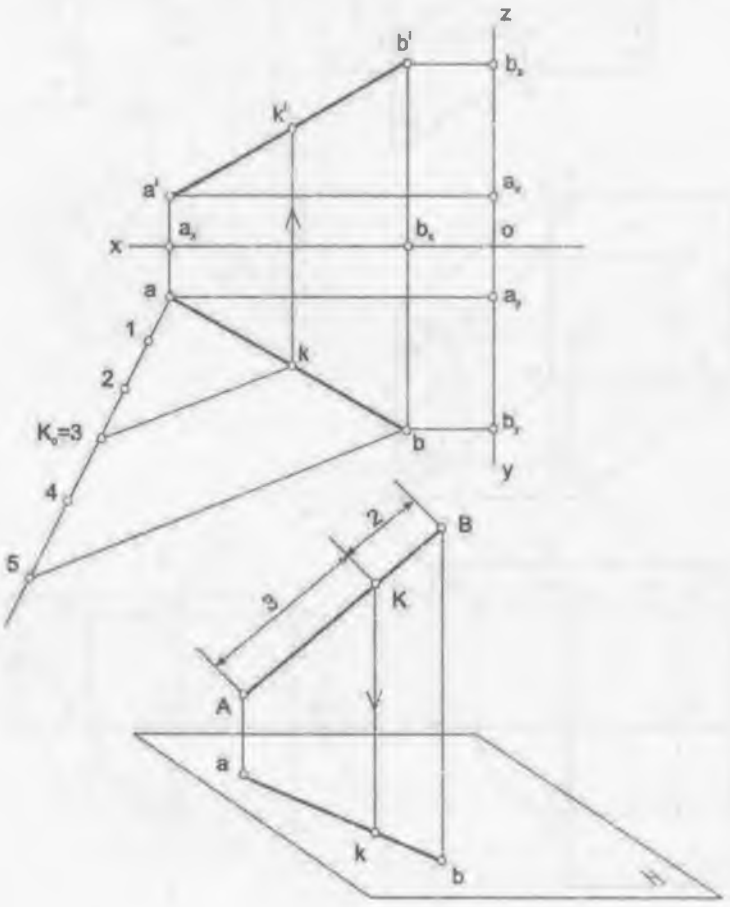




SUBJECT: DIRECT LINE.

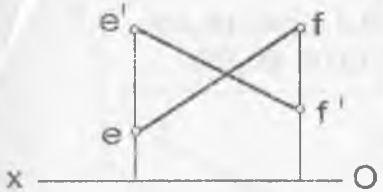
Example 8. On the line segment AB to determine the point K, divides the segment AB in the ratio $\frac{[AK]}{[KB]} = \frac{3}{2}$

A(70; 10; 10) **B(20; 35; 40)**

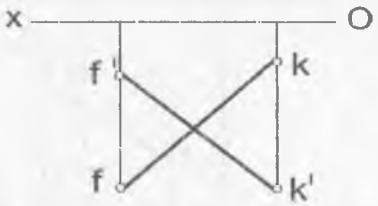


SUBJECT: DIRECT LINE.

9.5 E(90; -10; 35)
F(45; -35; 15)

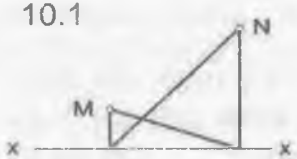


9.6 F(70; 30; -10)
K(25; 10; -35)

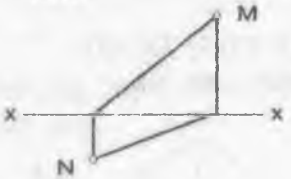


Example 10. Construct the projections of the line BC, knowing the signs. Determine the visible part of the invisible. Specify the angle of the space through which it passes.

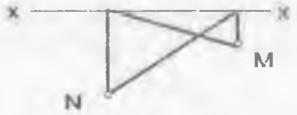
10.1



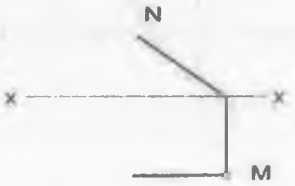
10.2



10.3



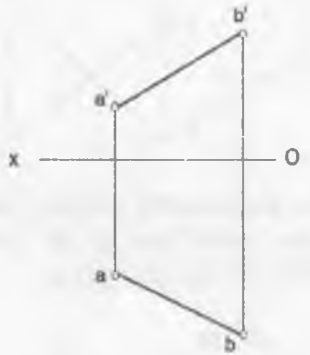
10.4



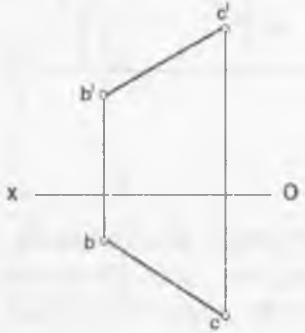
SUBJECT: DIRECT LINE.

Example 9. Build a trace line and specify the angle of the space through which it passes.

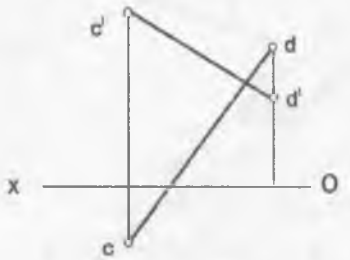
9.1 A(50; 50; 15)
B(20; 85; 35)



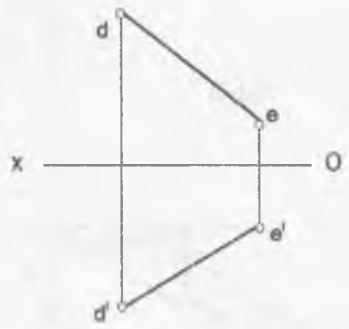
9.2 B(50; 15; 30)
C(10; 55; 55)



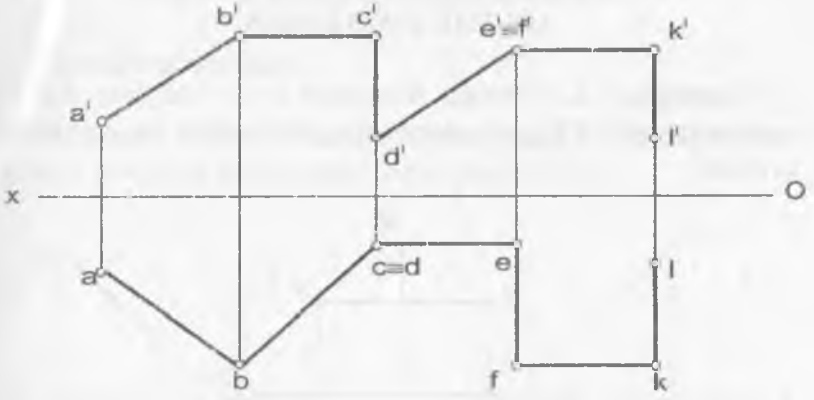
9.3 C(60; 20; 45)
D(25; -10; 20)



9.4 D(80; -45; -50)
E(40; -15; -25)



SUBJECT: DIRECT LINE.



Example 11. Determine the length of the broken line and specify the location of its components in space.

Example 12. According to the coordinates of the segment construct diagrams. Build a trace line and specify the angle of the space through which it passes.

a) **A(10; 30; 70)**
B(70; 60; 20)

b) **C(60; 50; 40)**
D(20; 10; 40)

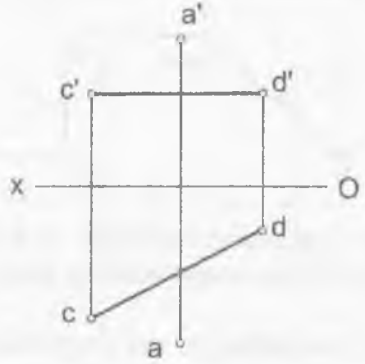
v) **E(60; 40; 20)**
F(10; 40; 40)

g) **K(40; 20; 35)**
L(40; 60; 60)

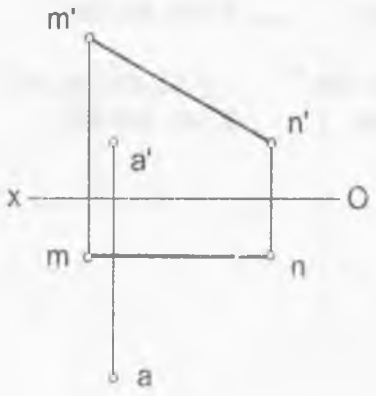
LESSON №5

SUBJECT: THE MUTUAL POSITION OF THE TWO LINES

Example 2. Through the point A to the line AB is perpendicular to CD and intersecting it. Consider the algorithm in detail.



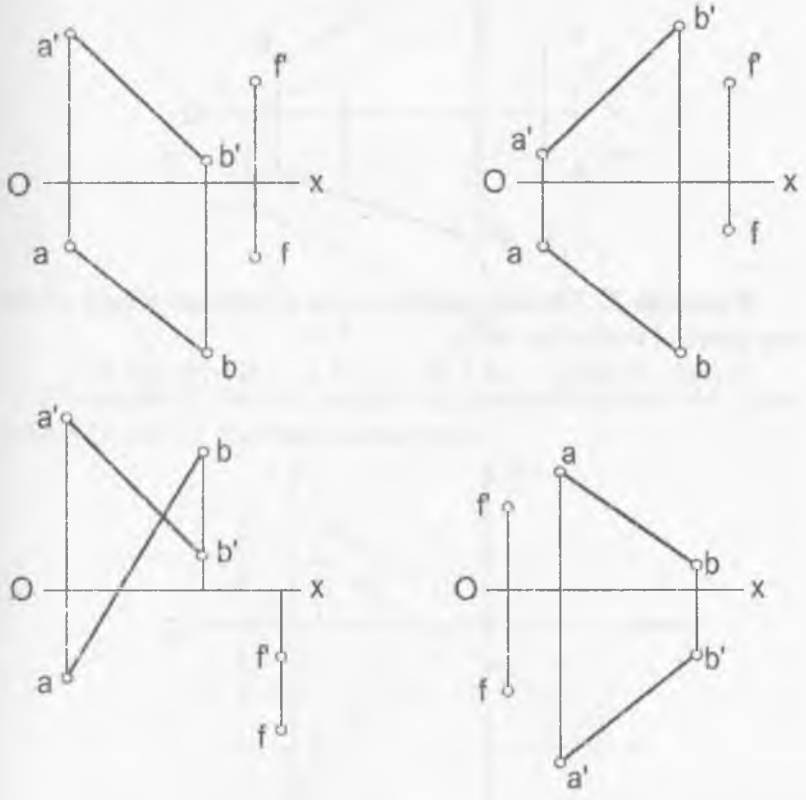
Example 3. Determine the distance from point A to the line MN. Build a sphere centered at the point A, the tangent to the line MN.



SUBJECT: THE MUTUAL POSITION OF THE TWO LINES.

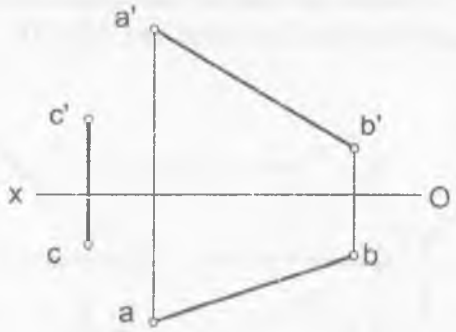
Parallel direct lines.

Example 1. Given the line AB and point F. Through point A draw a straight line parallel to the line AB CD.



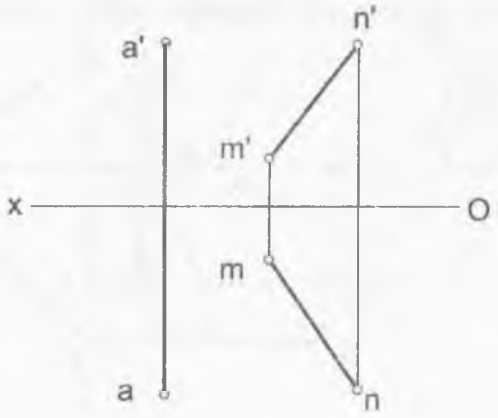
SUBJECT: THE MUTUAL POSITION OF THE TWO LINES.

Example 2. Through C draw a straight line parallel to the CD H, intersecting the given line AB.



Example 3. Through a point A to a segment length of 50 mm parallel to the line MN.

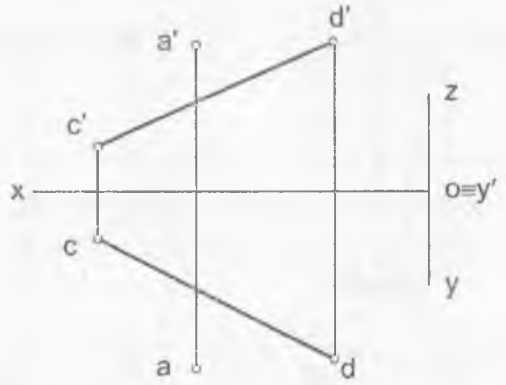
A (65; 35; 40), M (45; 15; 15), N (10; 45; 40).



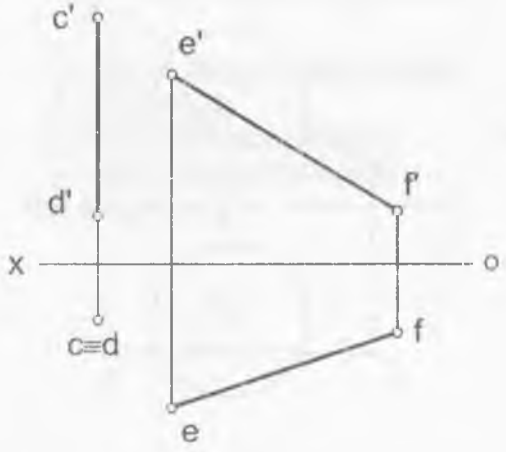
LESSON №6

SUBJECT: THE MUTUAL POSITION OF THE TWO LINES.

Example 1. Through the point A to the line AB intersecting the axis OY and projections given line CD.

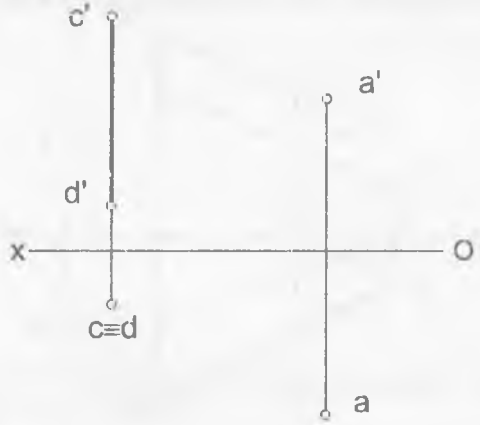


Example 2. Build a straight AB, perpendicular to the given lines CD and EF and intersecting them.

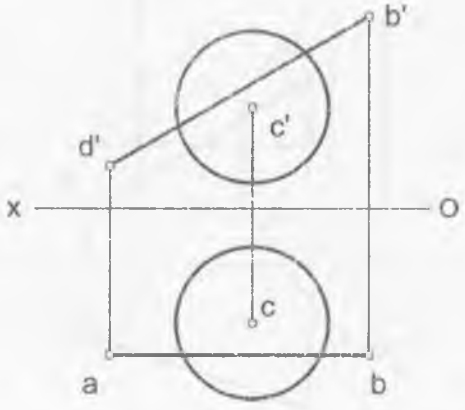


SUBJECT: THE MUTUAL POSITION OF THE TWO LINES.

Example 3. Through point AB to A horizontal remote from a given line CD is 30 mm.

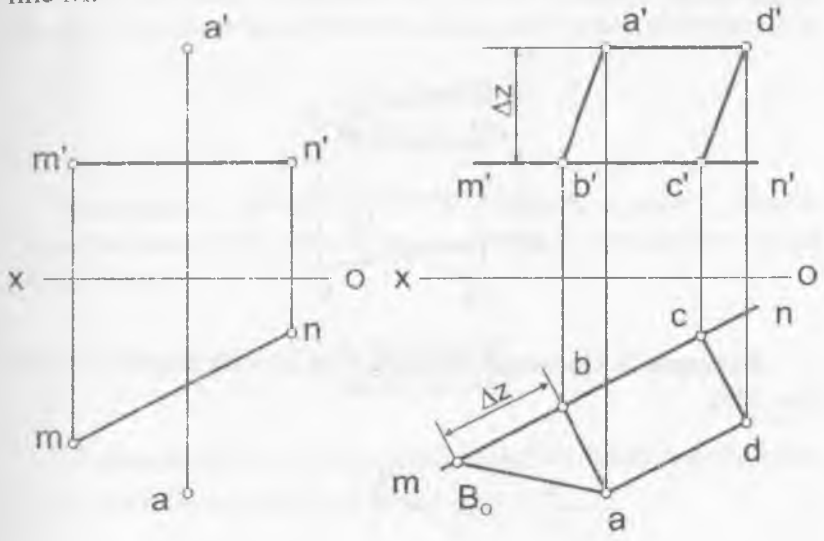


Example 4. Find the point of intersection of AB with the surface of the ball.



SUBJECT: COMPLEX TASKS.

Example 1. Construct a square ABCD with side BC on the line M.

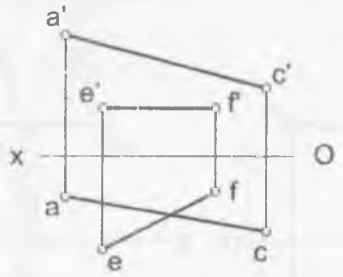


Algorithmic solution of problem.

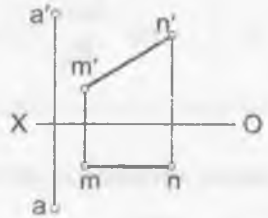
1. [AB] ⊥ (MN) ∧ [AB] ∩ (MN)
2. |AB|=|aB₀|
3. |BC|=|AB|⇒|bc|=|aB₀|
4. [CD] ∥ [AB] ∧ |CD|=|AB|
5. [AD] ∥ [BC]

SUBJECT: COMPLEX TASKS.

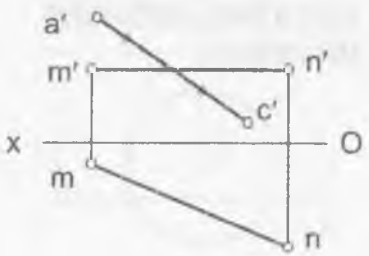
Example 2. Construct a right triangle ABC with right angle in the line EF.



Example 3. Construct a square ABCD with side BC on the line MN.



Example 4. Construct a square ABCD with diagonal BD on the line MN.



"POINT" AND "DIRECT".

Example 1. According to the coordinates of the points A and B to construct diagrams of AB, determine the length and angles of inclination of the line AB to each plane of projection.

A(10; 10; 50)
B(40; 30; 10)

Example 2. On the line AB to construct a point C, remote from the plane H by 40 mm and the point D, remote from point A to 20 mm.

A(90; 45; 10)
B(30; 10; 55)

Example 3. On the line segment AB to determine the point K, divides the segment AB in the ratio $\frac{[AK]}{[KB]} = \frac{3}{2}$

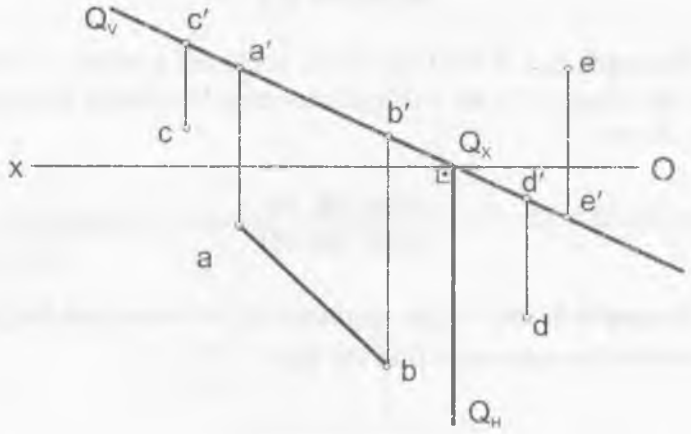
A(80; 50; 20)
B(30; 10; 55)

LESSON №7

SUBJECT: PLANE.

Example 1. Through the line AB to the possible positions of the private plane.

For each plane to take an arbitrary one point in each corner of the space through which it passes.



1. $Q \subset (AB) \wedge Q \perp V$?

$Q(Q_V, Q_H)$?

$Q \subset (AB) \wedge Q \perp V \Rightarrow Q_V \equiv (a'b') \wedge Q_H \perp (Ox)$

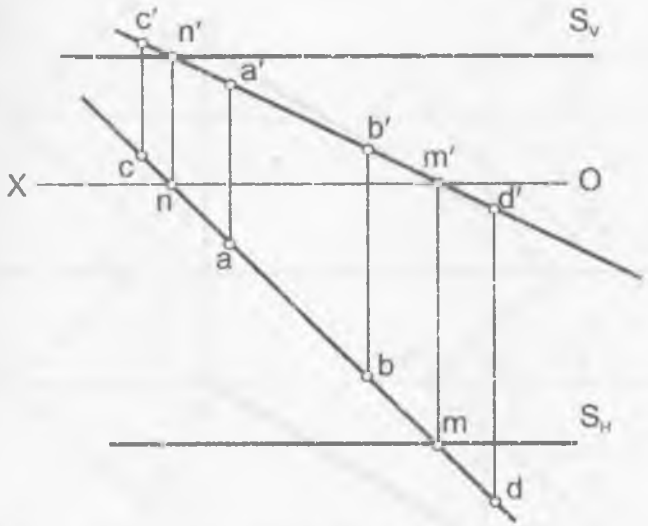
$Q \subset$ I, II, III, IV

A∈I, C∈II. D∈IV. E∈III

2. $T(T_H, T_V) \subset (AB) \wedge T \perp H$

Do your own.

3. $S(S_H, S_V) \subset (AB) \wedge S \perp W$



$S(S_H, S_V) \subset (AB) \wedge S \perp W \Rightarrow S_V,$
$S_H \parallel (OX) \wedge M \in S_H \wedge N \in S_V$

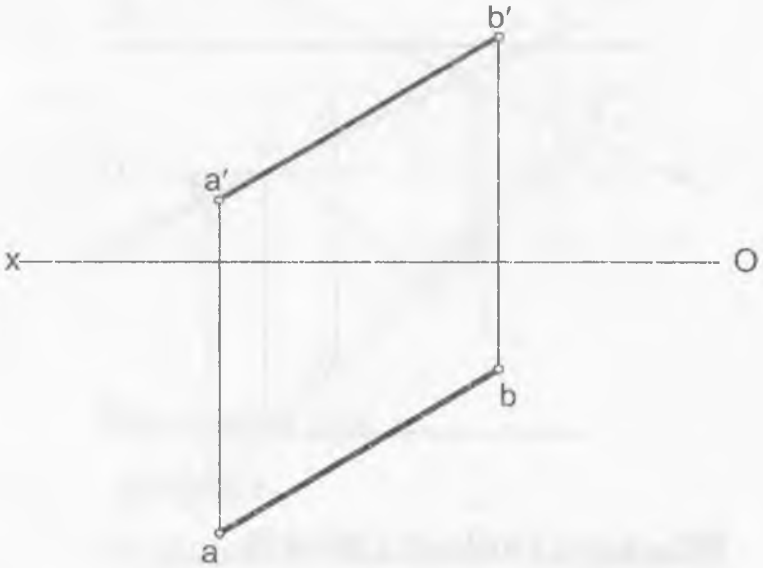
$S \subset II, I, IV$

$A \in I, C \in II, D \in IV$

SUBJECT: PLANE.

Example1. Through the line AB to the possible positions of the private plane.

For each plane on the line AB take one arbitrary point in each quarter, through which it passes.

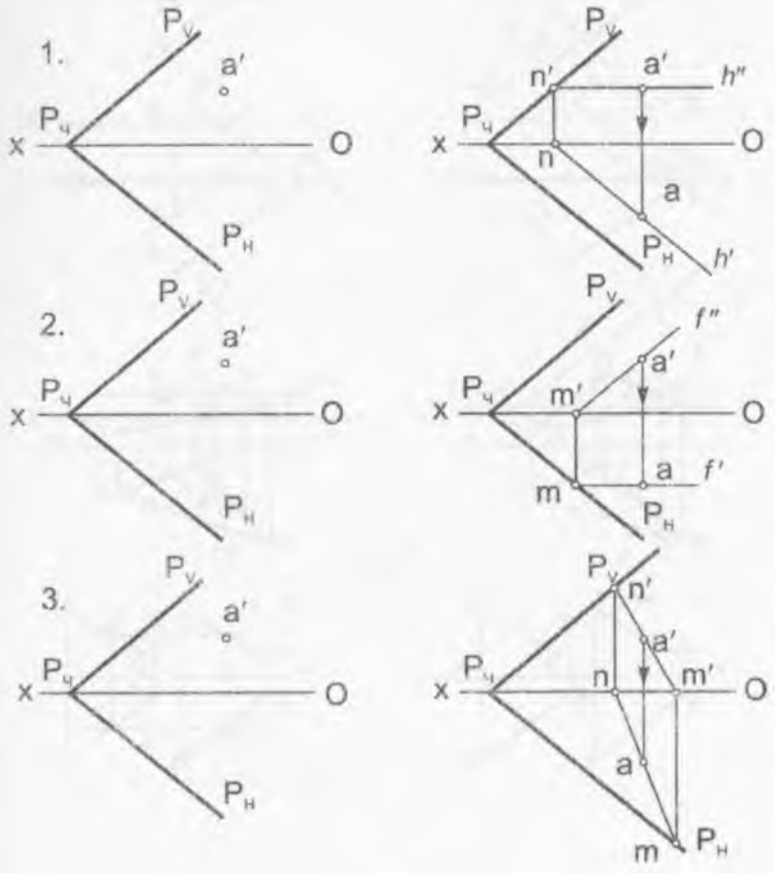


LESSON №8

SUBJECT: PLANE.

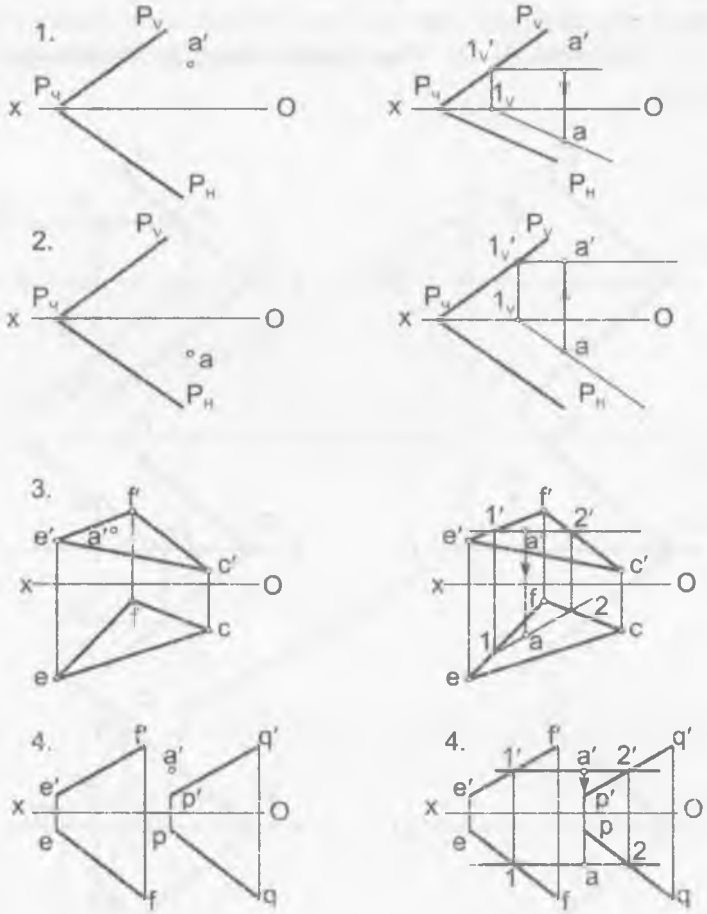
Example 1. For a point in the plane and a predetermined one projection finish missing projection

1) Horizontally. 2) The frontal line. 3) Direct general position.



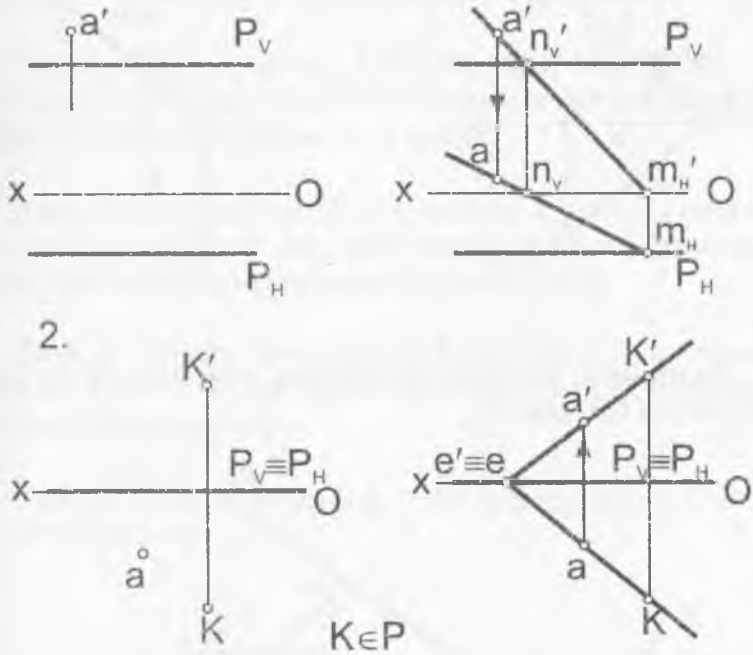
SUBJECT: PLANE.

Example 2. Through the point A of this plane to the horizontal in it.



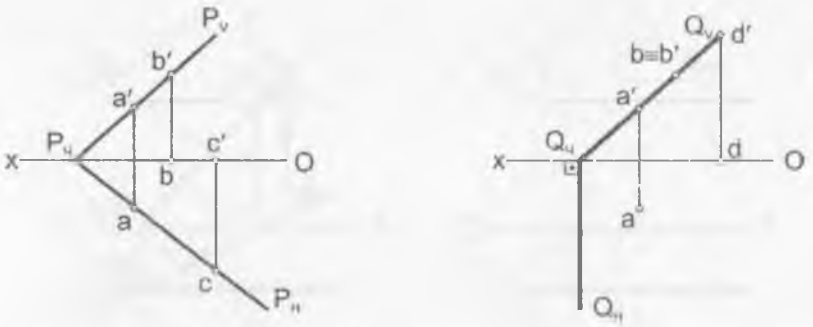
SUBJECT: PLANE.

Example 3. To determine the missing projections of the points profiled projecting the plane to use the auxiliary lines in general position.

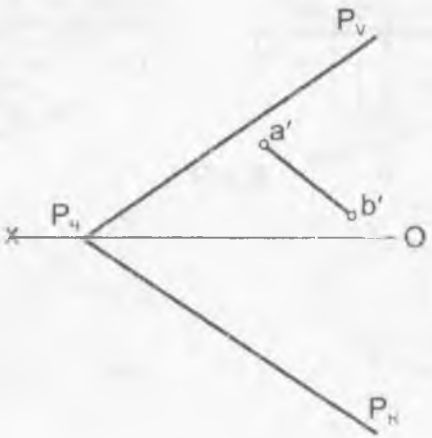


SUBJECT: PLANE.

Example 3. Determine the identity of the plane for the data points.



Example 4. Complete the missing projection of the line AB, owned the plane P.



SUBJECT: POINT. DIRECT LINE. PLANE.

Control work number 1
The ticket number 0

Task 1. Build a horizontal and frontal traces the line AB and show a quarter of the space through which it passes.

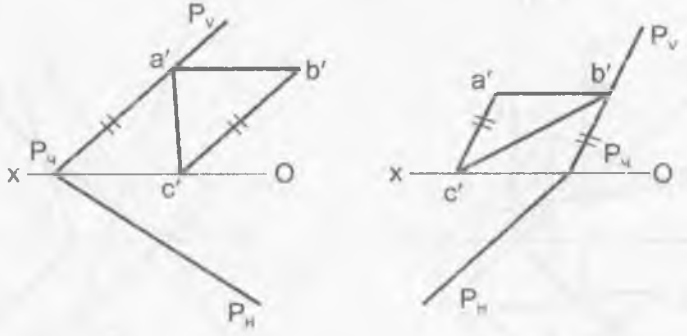
The coordinates of point: **A (35, 65, 45), B (60, 40, 20).**

Task 2. Determine the life-size segment AB and line AB angles to the plane of projection V and N.

Task 3. On the line AB to construct a point C, remote from the z-axis by 50 mm, and through it to the front line perpendicular to AB and intersecting plane H at M.

Task 4. Divide the segment AB at point D on blood pressure: LW = 3, 5, and draw a horizontal line that intersects the z-axis at the point M.

Task 5. Build a projection of the missing triangle ABC, owned the plane P.

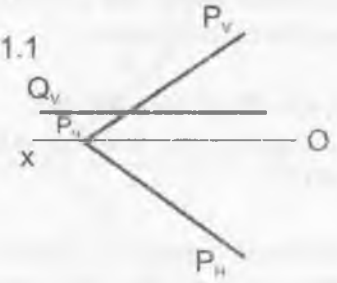


LESSON №10

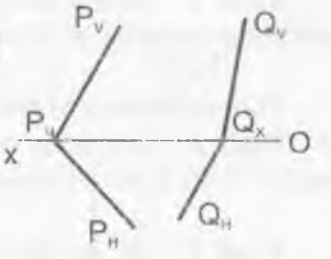
SUBJECT: TWO PLANE.

Example 1. Construct the projections of the line of intersection of these planes.

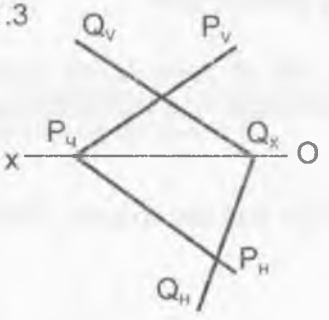
1.1



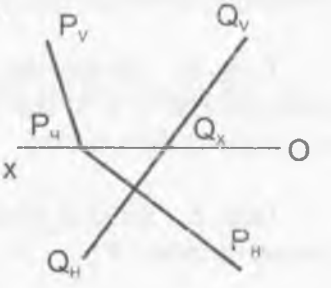
1.2



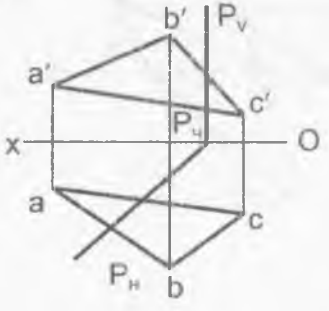
1.3



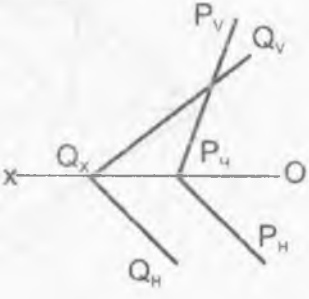
1.4



1.5



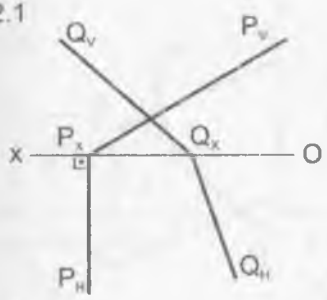
1.6



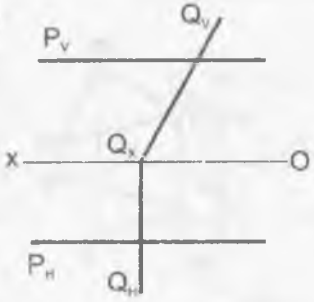
SUBJECT: TWO PLANE.

Example 2. Construct the projections of the line of intersection of these planes.

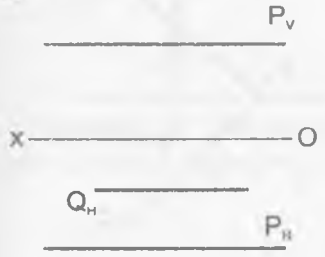
2.1



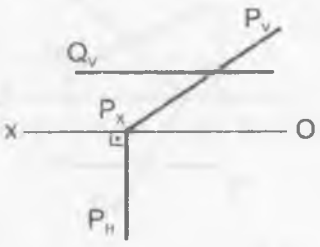
2.2



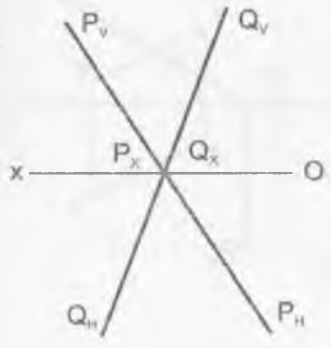
2.3



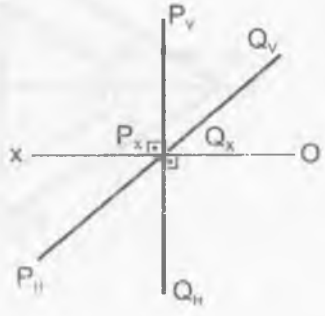
2.4



2.5



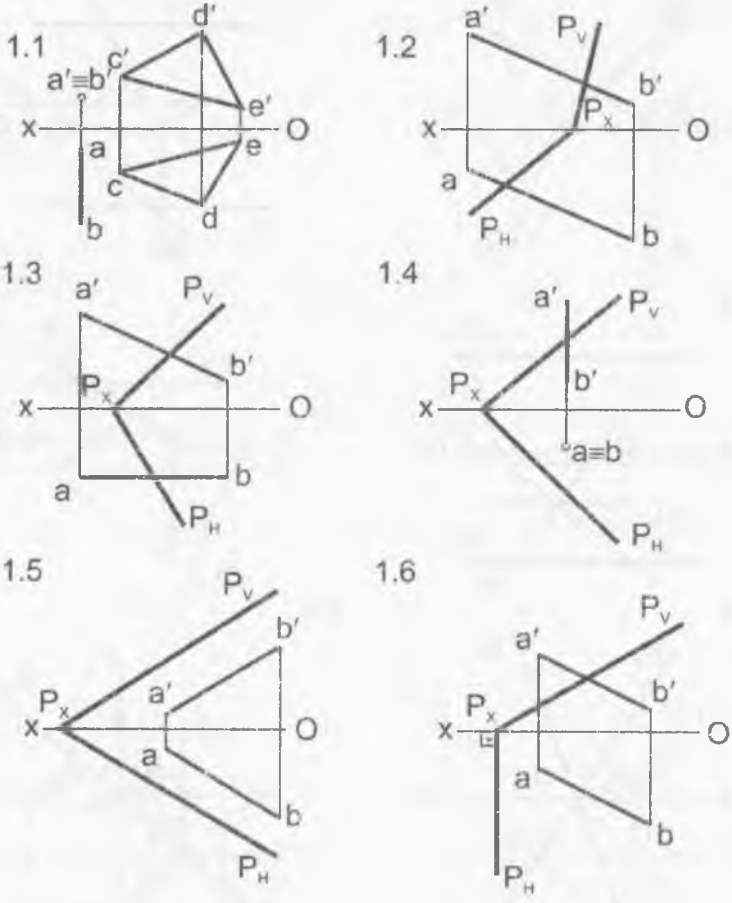
2.6



LESSON №11

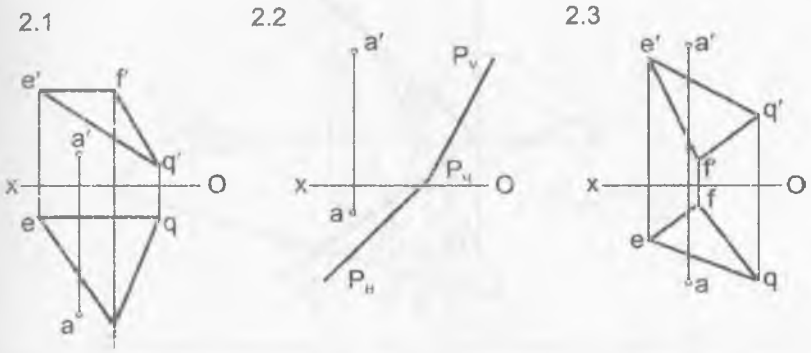
SUBJECT: LINES AND PLANES.

Example 1. Find the point of intersection of the line AB and data planes.

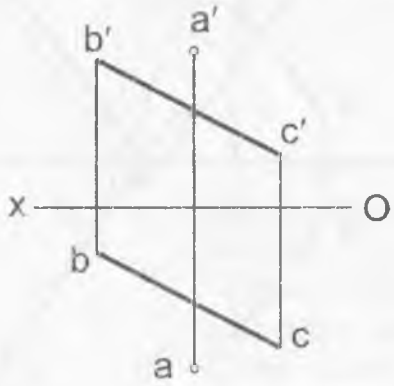


SUBJECT: LINES AND PLANES.

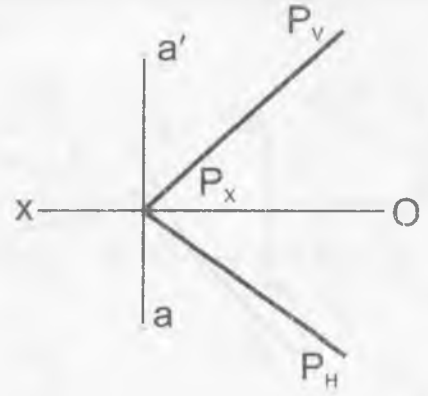
Example 1. Through point A draw a straight line perpendicular to this plane and put it on a segment length of 30 mm.



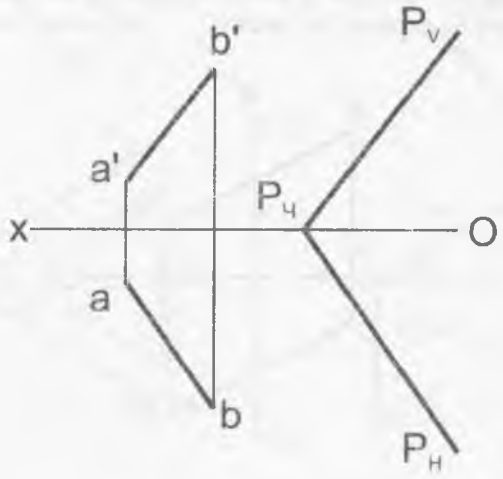
Example 2. Through A perpendicular to the plane P of the direct sun and to express its tracks.



Example 3. A projected point on the plane P.

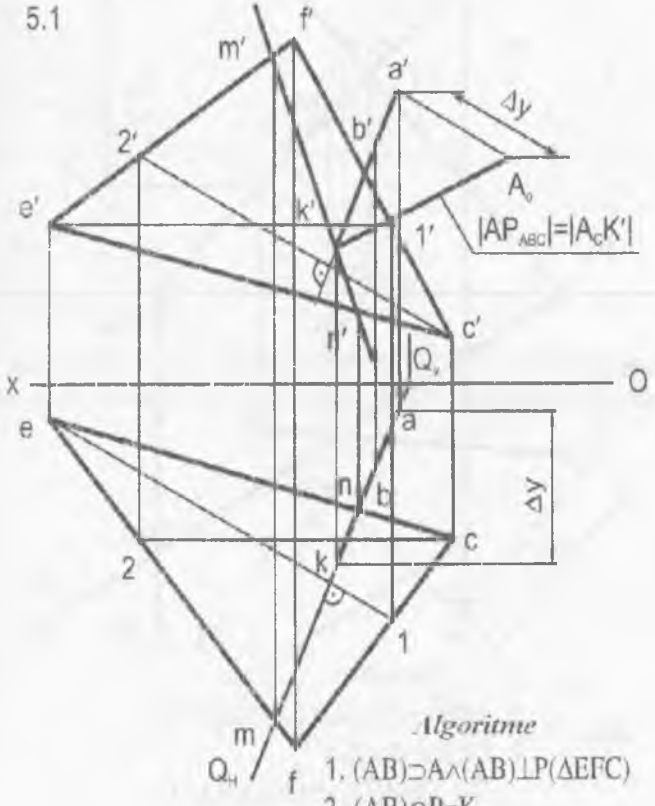


Example 4. Through the line AB is perpendicular to the plane Q of the plane P and expresses its tracks.



SUBJECT: LINES AND PLANES..

Example 5 Determine the distance from point A to a given plane.

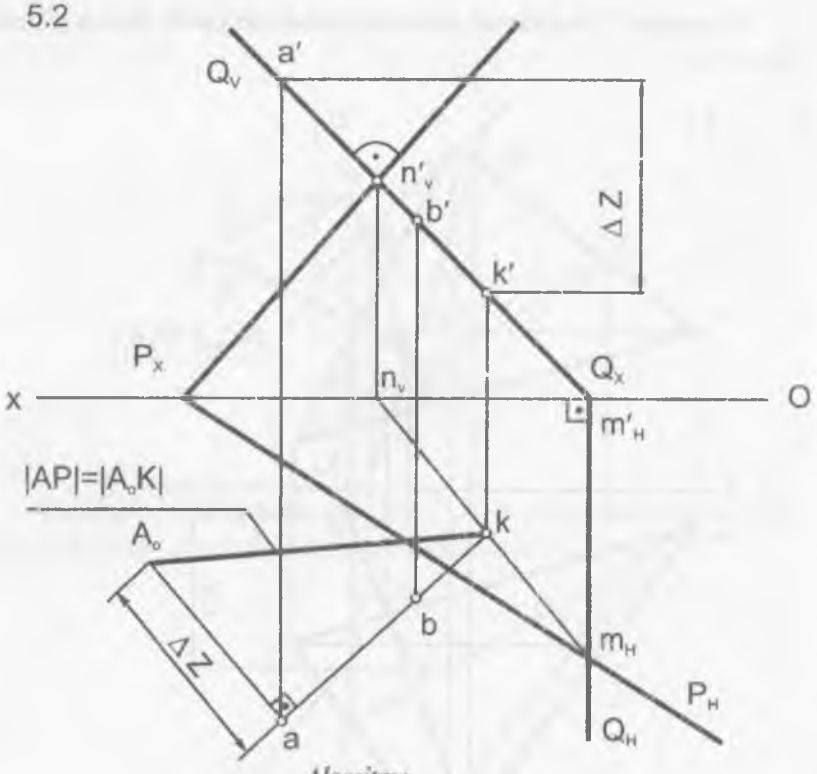


Algoritme

1. (AB)⊃A∧(AB)⊥P(ΔEFC)
2. (AB)∩P=K
   2.1Q(Q$_v$Q$_{II}$)⊃(AB)∧Q⊥H
   2.2Θ∩P(ΔEFC)=(MN)
   2.3(MN)∩(AB)=K
3. |AK|=|AP(ΔEFC)|

SUBJECT: LINES AND PLANES.

5.2

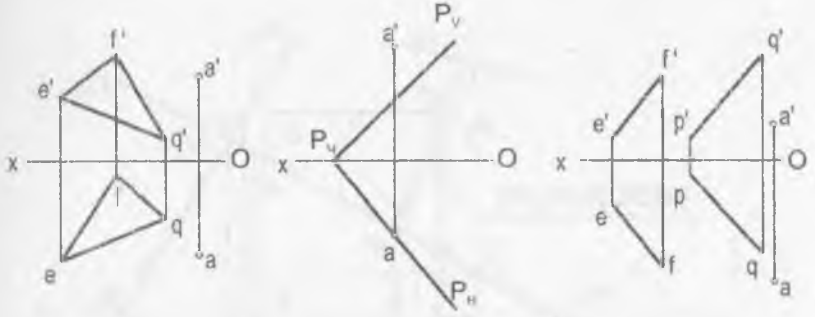


Algoritme

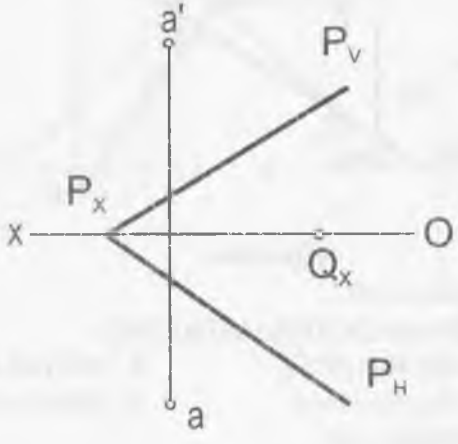
1. (AB)⊃A∧(AB) ⊥P(ΔEFC)
2. (AB)∩P=K
   2.1 Q(Q_VQ_H)⊃(AB)∧Q⊥V
   2.2 Q∩P=(MN)
   2.3 (MN)∩(AB)=K
3. |AK|=|AP(P_VP_H)|

SUBJECT: LINES AND PLANES.

Example 6. Determine the distance from point A to a given plane.

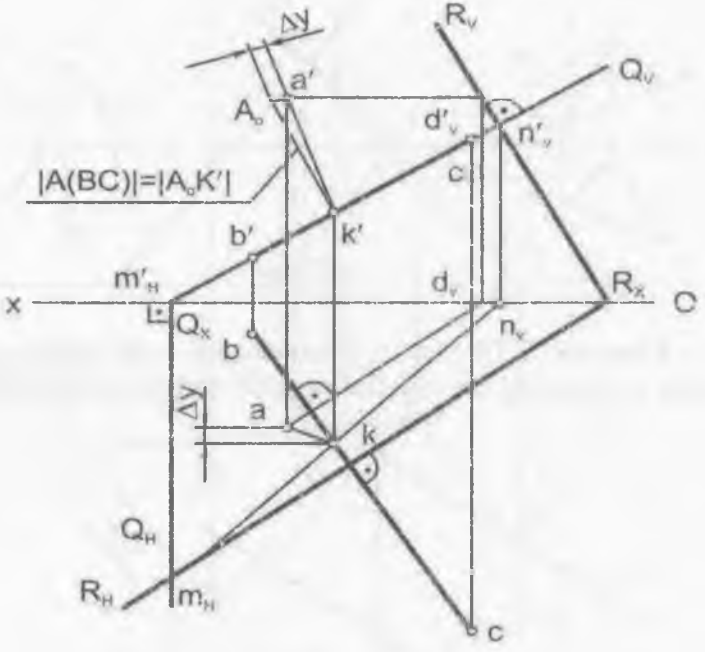


Example 7. Through A perpendicular to the plane Q of the plane and passing through the point of vanishing traces QX.



SUBJECT: LINES AND PLANES.

Example 8 Determine the distance from point A to the line BC.

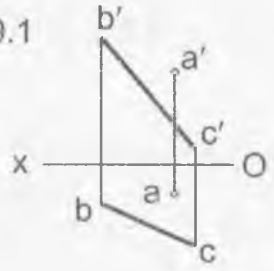


Algoritme

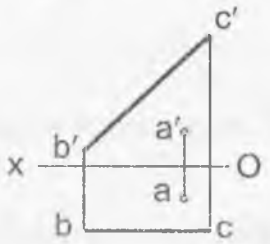
1. $A \supset R(R_vR_H) \perp (BC)$
   - 1.1 $(AD) \in A \wedge (AD) \| H \wedge (AD) \perp (BC)$
   - 1.2 $R_v \in D \wedge R_v \perp (b'c')$
   - 1.3 $R_v \in R_x \wedge R_v \perp (bc)$
2. $(BC) \cap R(R_vR_H) = K$
   - 2.1 $R(R_vR_H) \supset (BC) \wedge Q \perp V$
   - 2.2 $Q \cap R = (MN)$
   - 2.3 $(MN) \cap (BC) = K$
3. $[AK] = A_oK'$
4. $|AK| = |A(BC)|$

Example 9. Determine the distance from point A to the line BC.

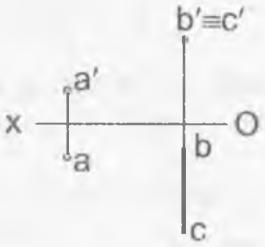
9.1



9.2



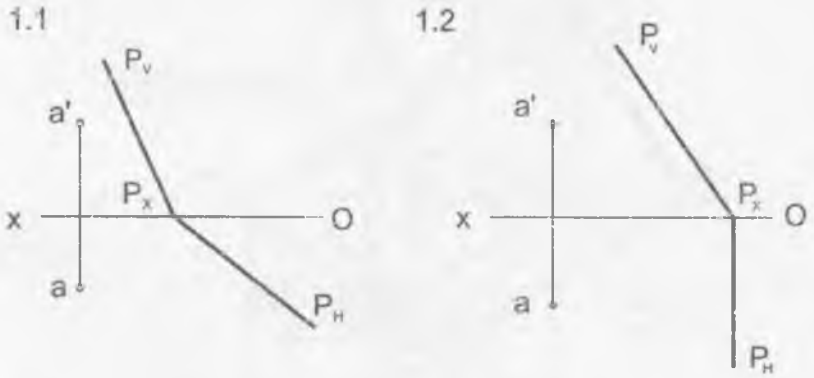
9.3



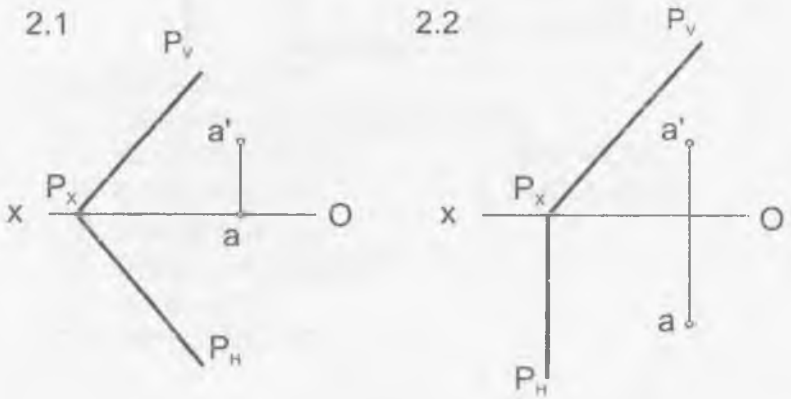
LESSON №12

SUBJECT: PARALLEL OF LINE AND A PLANE, PARALLEL TO THE PLANE.

Example 1. Through point A draw a straight line AB parallel to that plane and the plane of the projection H and put it on the cut length of 30 mm.

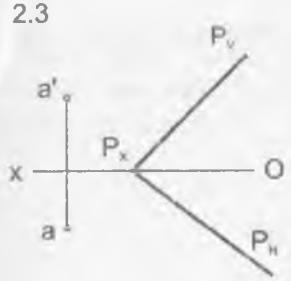


Example 2. Through A to G plane parallel to that plane, and express its tracks

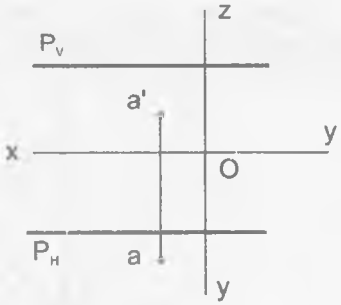


SUBJECT: PARALLEL OF PLANES.

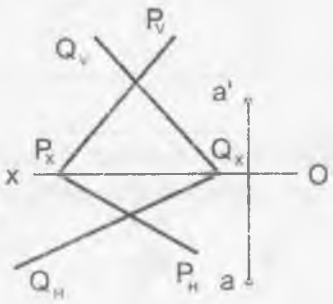
2.3



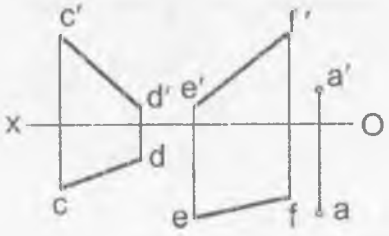
2.4



Example - 3. Through point A draw a straight line parallel to the two given planes.

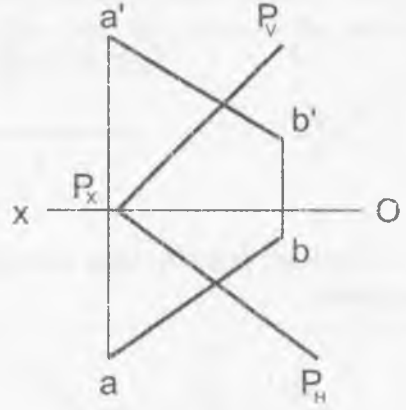


Example 4. Through point A to plane parallel to the direct CD and EF, and to express its tracks.

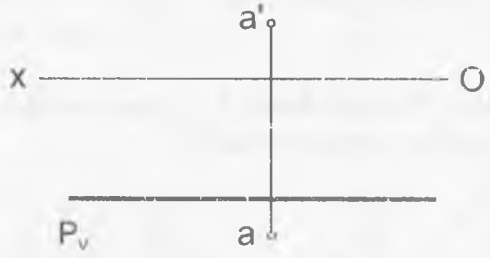


SUBJECT: PARALLEL OF PLANES.

Example 5. On the line AB to construct a point C distant from this plane by 20 mm.



Example 6. Build a set of points removed from this plane at a distance of 15 mm and from this point on 25mm.



LESSON №13

Subject: Surfaces

Example1. According to the projections of the known point on the surface of the body geometry and finish her missing projection.

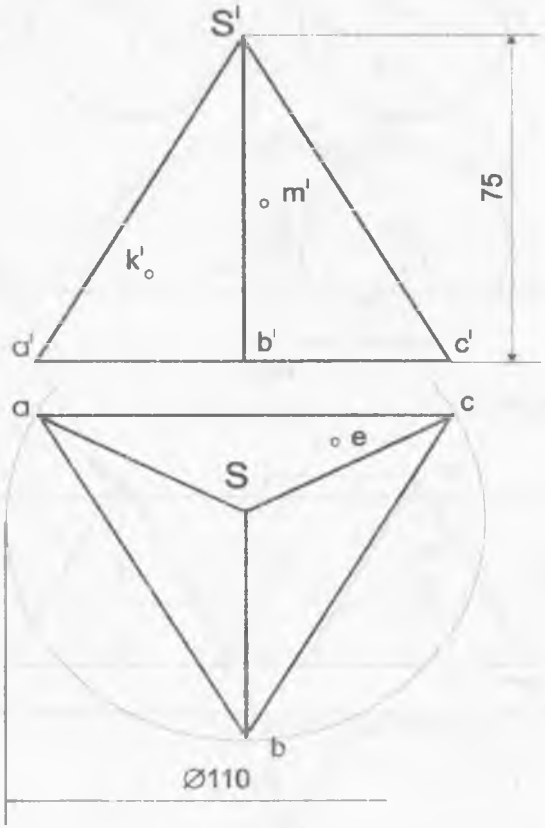


fig. 1

SUBJECT: SURFACES

Example - 2.

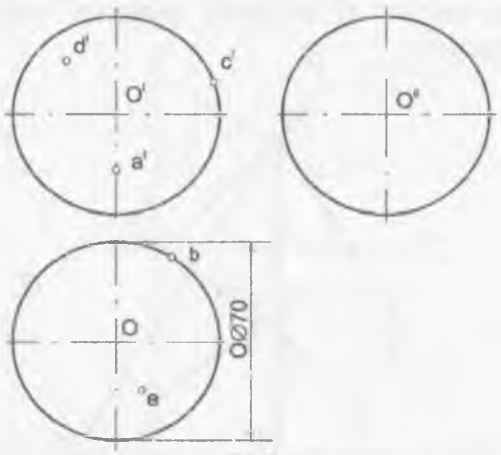


fig.2

Example - 3.

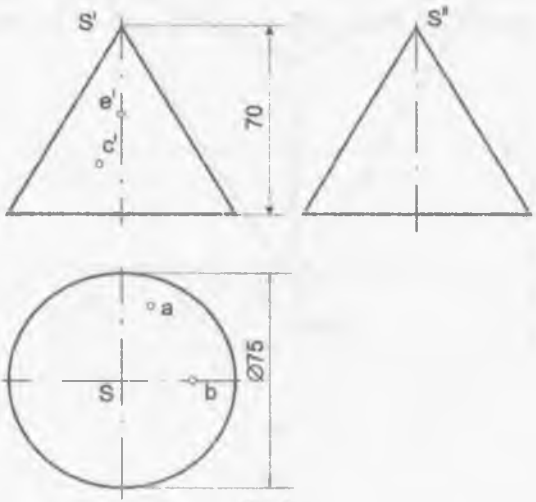


fig.3

SUBJECT: SURFACES

Example - 4.

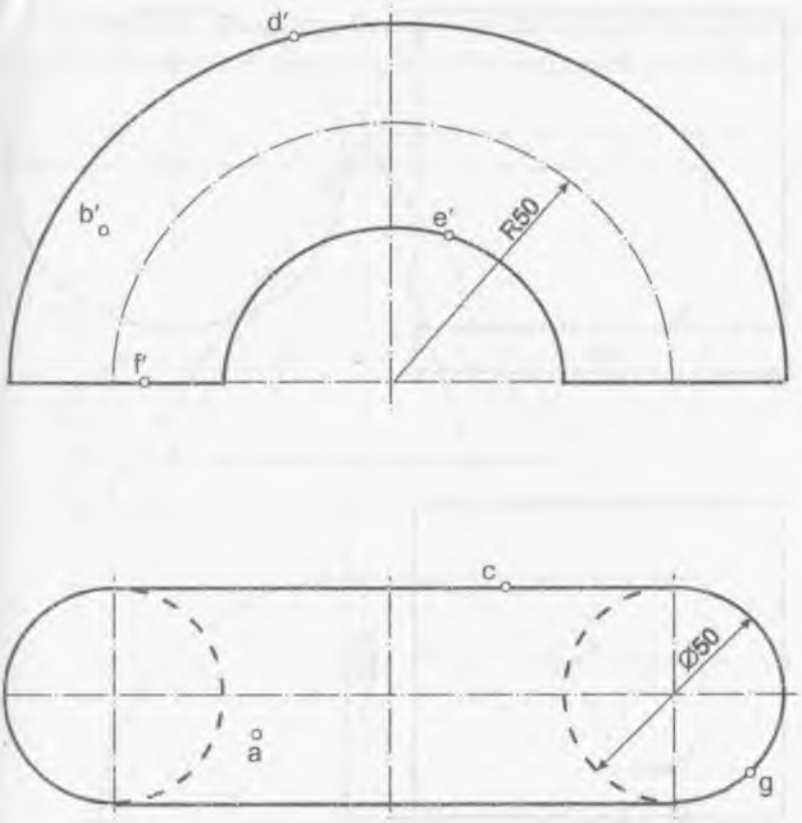


fig.4

SUBJECT: SURFACES

Example - 5.

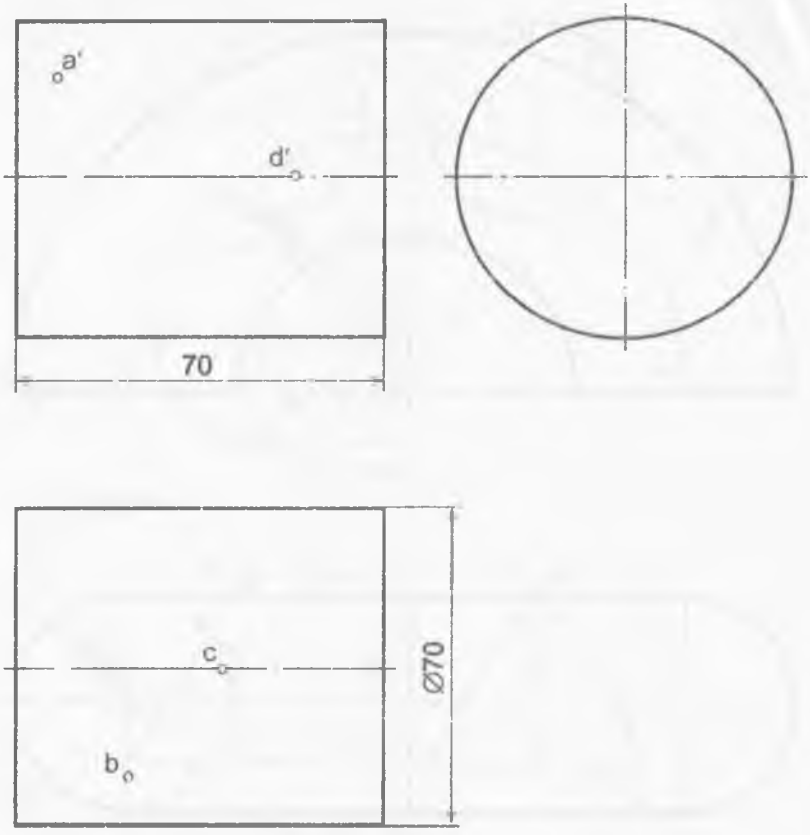
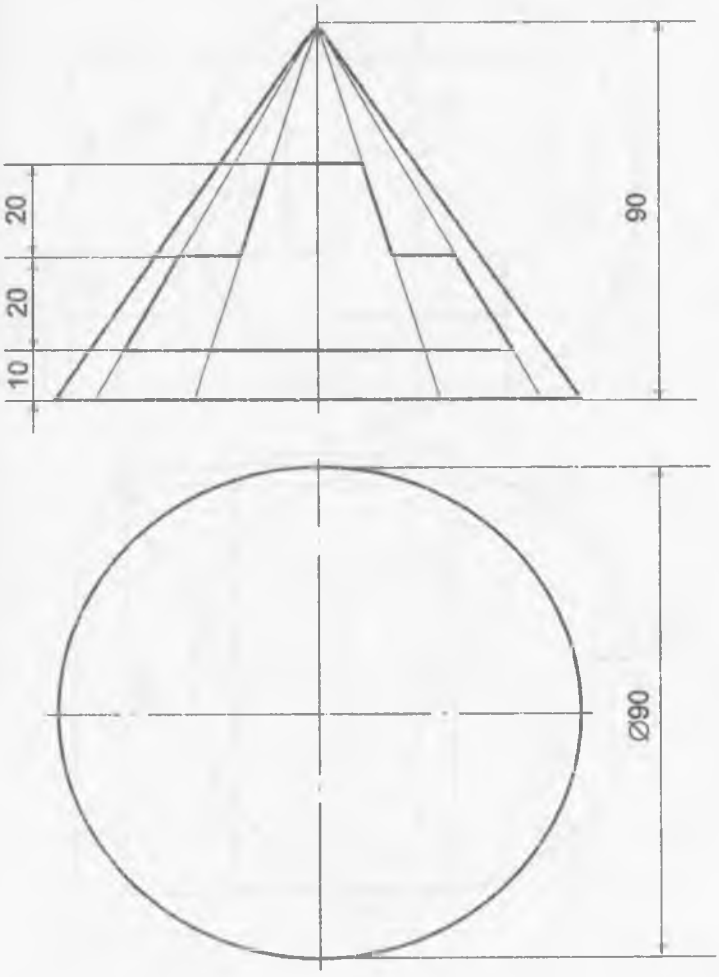


fig.5

LESSON №14

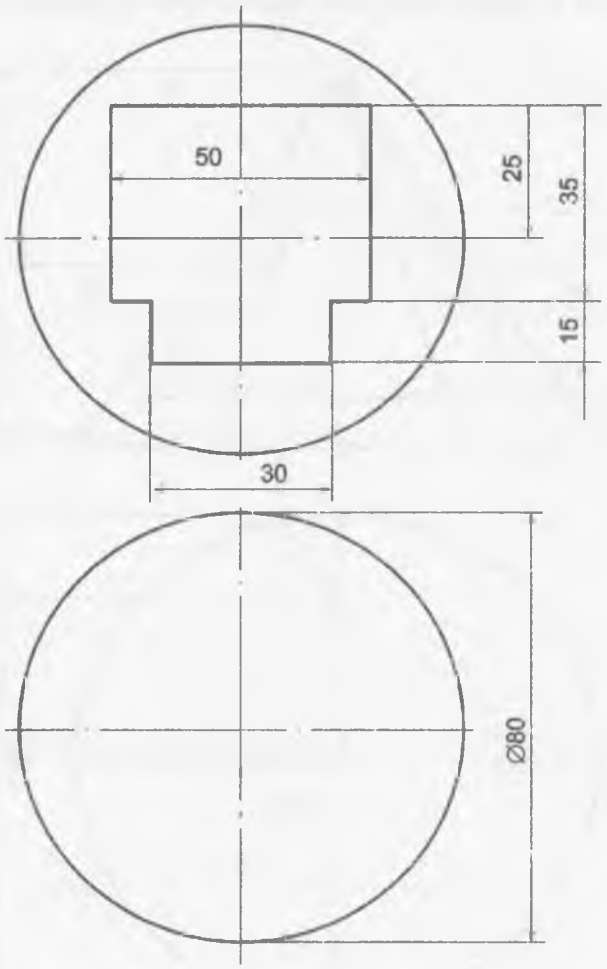
SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

Example1. According front projection figures belonging to the visible surface of the cone, build its horizontal projection.



SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

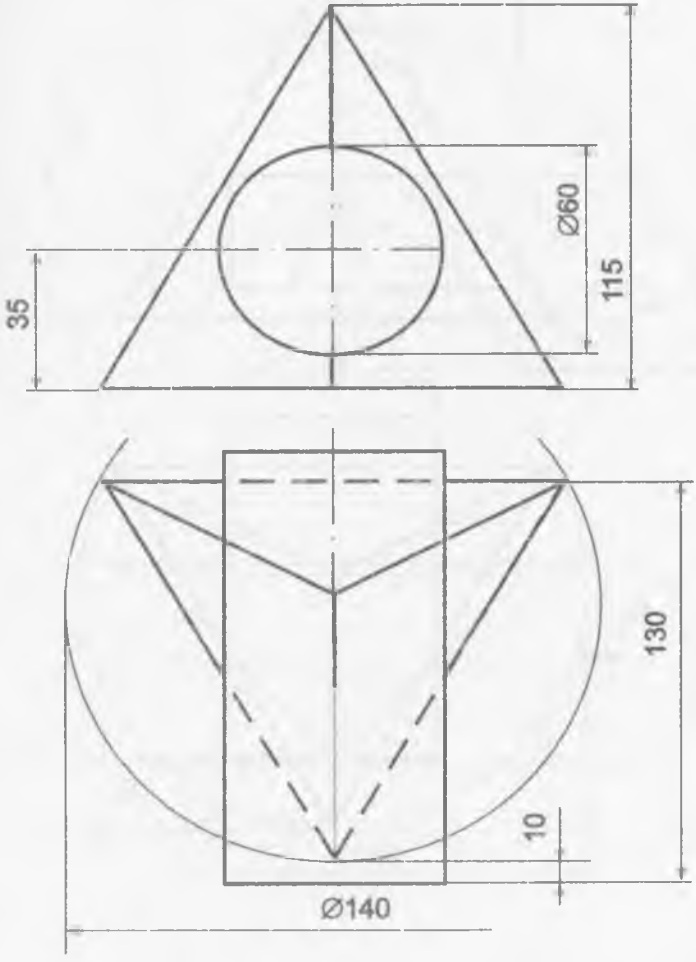
Example 2. Construct a horizontal projection of the sphere with a cut.



LESSON №15

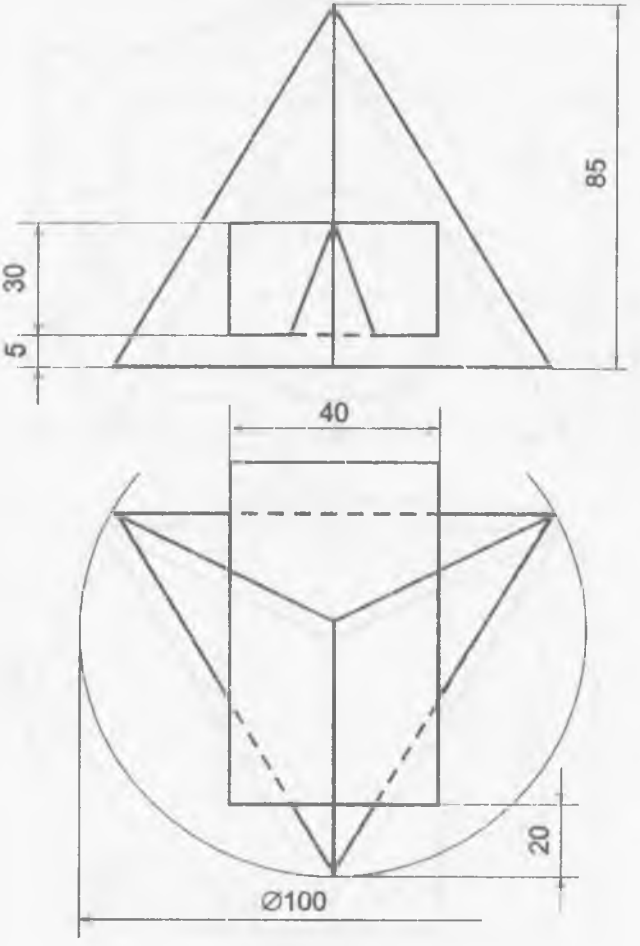
SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

Example - 3. Construct the projections of the line of intersection of these geometric solids.



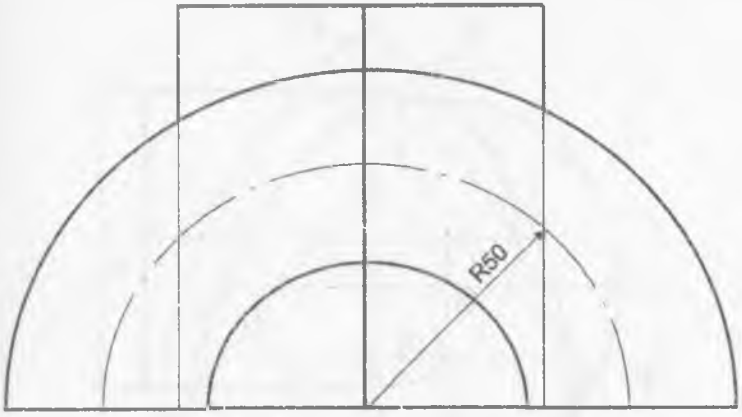
SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

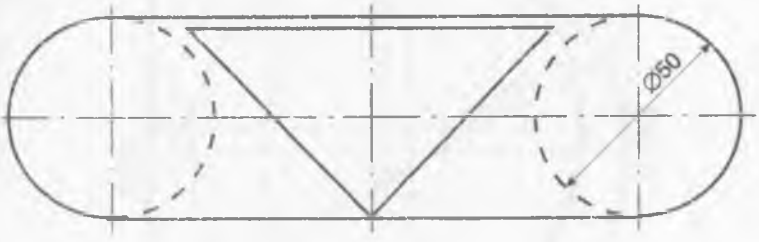
Example 4. Construct the projections of the line of intersection of these geometric solids.



SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

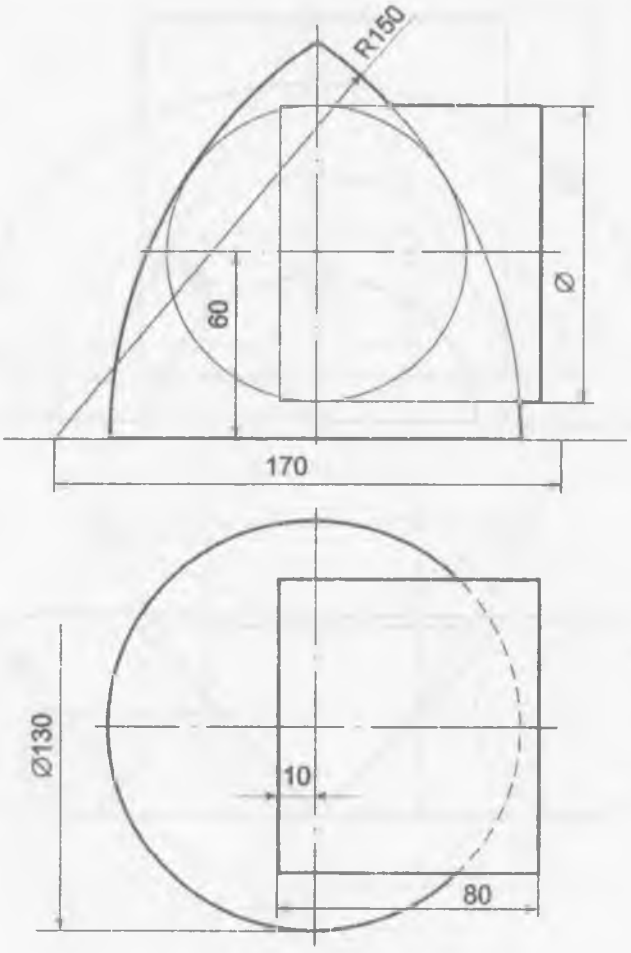
Example - 5. Construct the projections of the line of intersection of the solids.





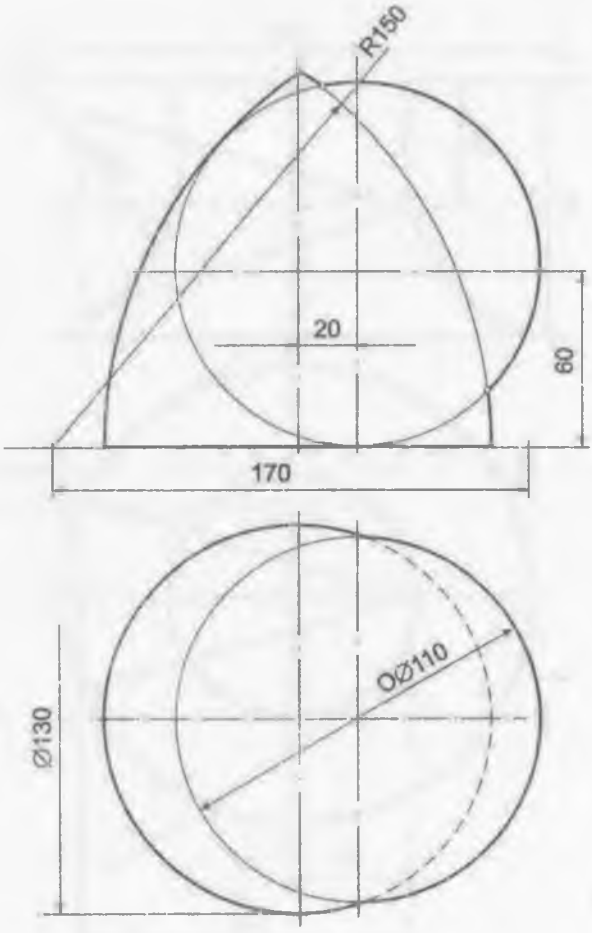
SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

Example - 6. Construct the projections of the line of intersection of the solids.



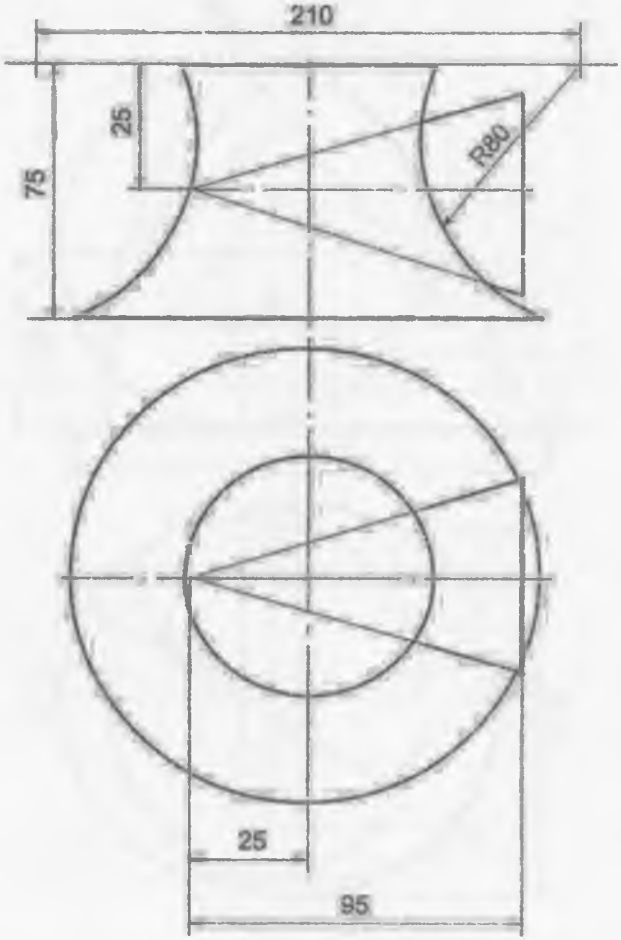
SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

Example - 7. Construct the projections of the line of intersection of these geometric means of the subsidiary bodies of the spheres.



SUBJECT: THE INTERSECTION OF SURFACES WITH PLANES

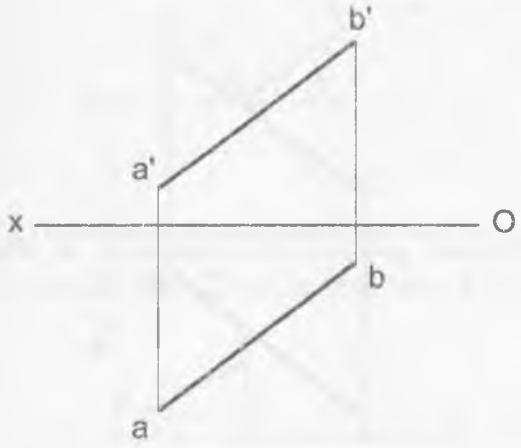
Example - 8. Construct the projections of the line of intersection of these geometric means of the subsidiary bodies of the spheres.



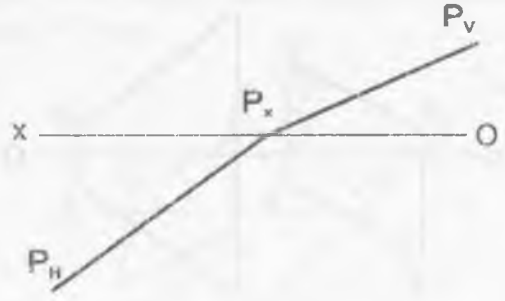
LESSON №16

SUBJECT: REPLACEMENT PROJECTION PLANES.

Example - 1. Determine the angle of inclination of the line AB to the plane of projection H.

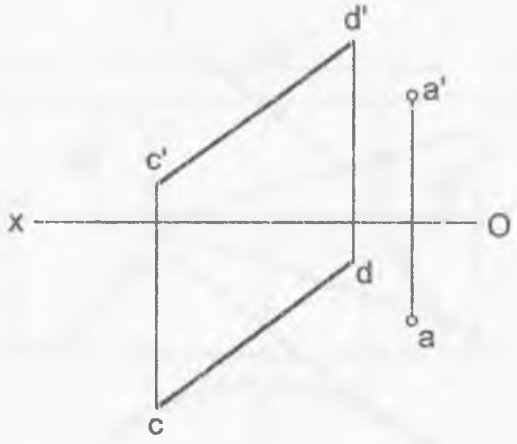


Example - 2. Determine the angle of inclination of the plane to the plane of projection P H.

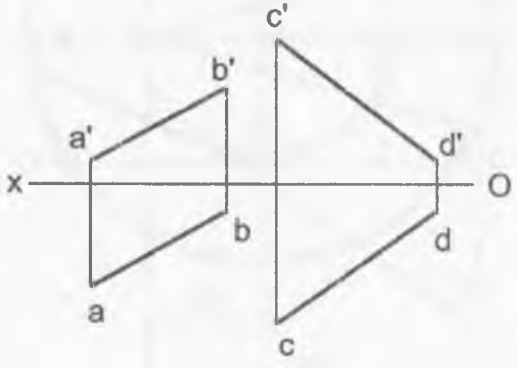


SUBJECT: HOW TO REPLACE THE PLANES PROJECTION.

Example - 3. Determine the distance from point A to the line CD.

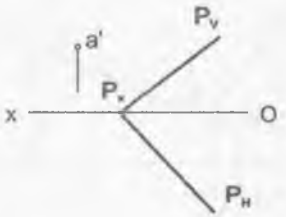


Example - 4. Определить расстояние между скрещивающимися прямыми **AB** и **CD**.

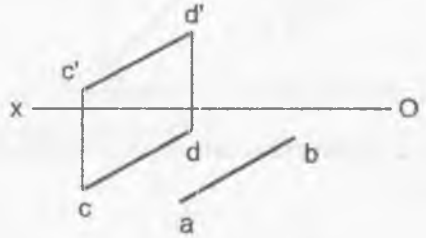


SUBJECT: HOW TO REPLACE THE PLANES PROJECTION.

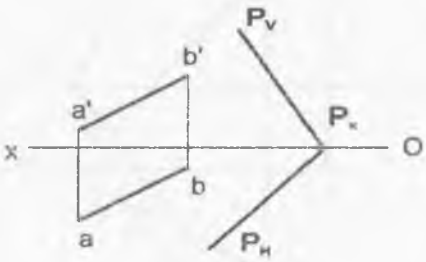
Example 5. Finish point A missing projection remote from the plane P of 20mm.



Example 6. Complete the missing projection of the segment AB parallel line CD and remote from it by 20mm.



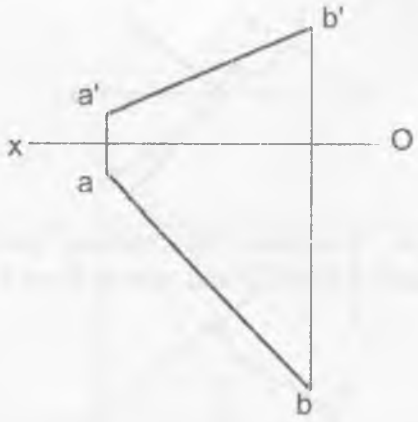
Example 7. On the line AB to construct a point C, remove from the plane P 20mm.



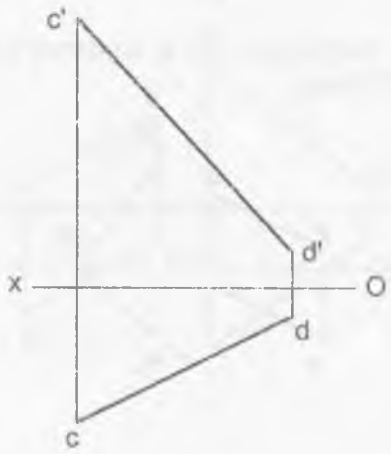
LESSON №17

SUBJECT: A METHOD OF ROTATION.

Example - 1. Determine the angle of inclination of the line AB to the plane H.

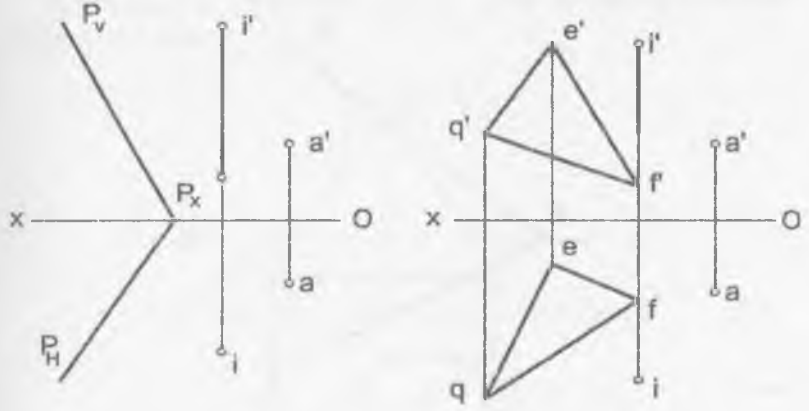


Example - 2. Determine the angle of inclination of the line CD to the plane V.

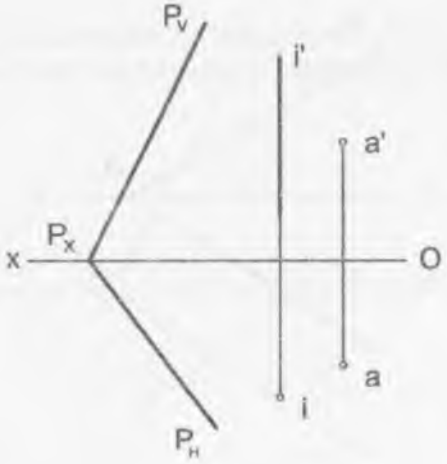


SUBJECT: A METHOD OF ROTATION.

Example - 3. Rotation around the axis-specific input point A in the plane P.

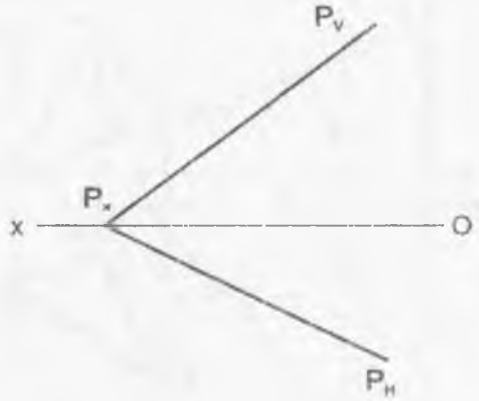


Example - 4. The plane P to turn around a given axis so that it passes through the point A.

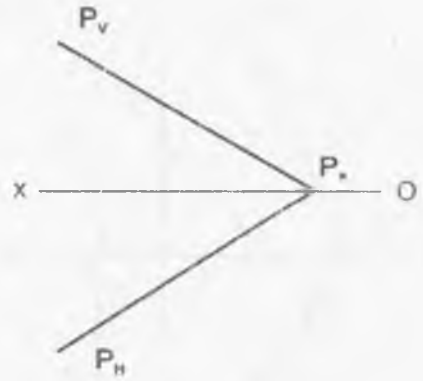


SUBJECT: A METHOD OF ROTATION.

Example - 5. By rotation determine the inclination of the plane P to the projection plane H.



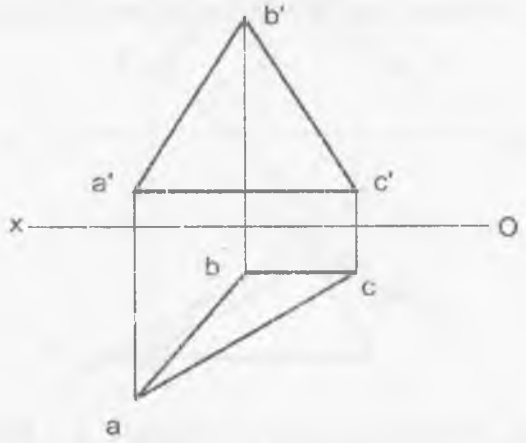
Example - 6. The way the rotation plane P translate into profile - projecting position..



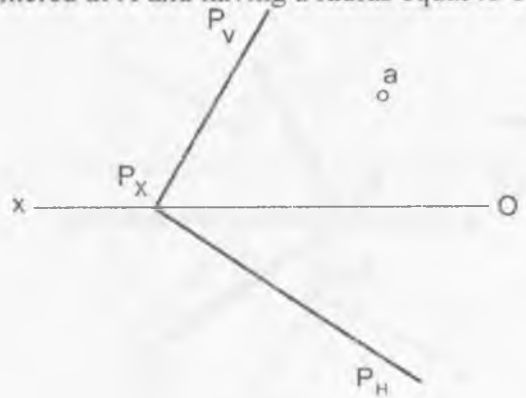
Exercise №18

SUBJECT: THE METHOD COMBINATION. DEFINITION OF ANGLES

Example - 1. Determine the full value of the triangle ABC method of rotation.



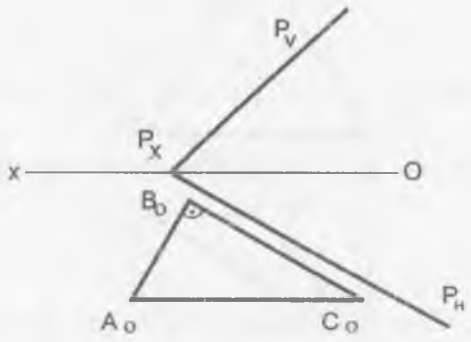
Example 2. Construct the projections of the circle located plane P, centered at A and having a radius equal to 15 mm.



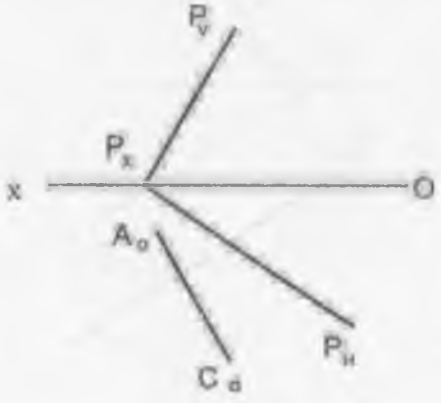
LESSON №18

THEME: THE COMBINATION METHOD. DEFINITION OF ANGLES COMBINING.

Example 3. Given aligned with the plane of the H.
Position of the triangle ABC, owned by P.
Build a horizontal and frontal projection of this triangle.

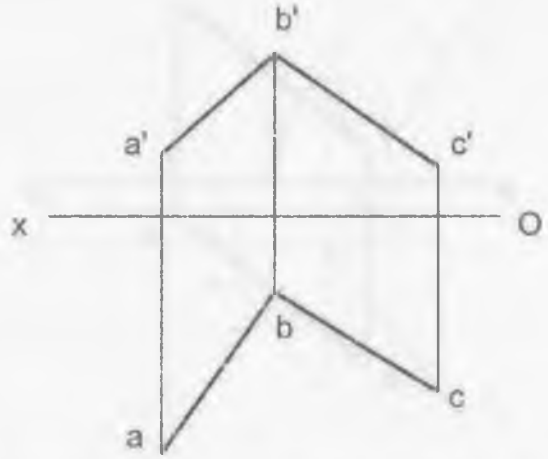


Example - 4. In the plane P to construct a right triangle ABC with vertex B, owned by the horizontal plane of the track, AOCO - combined position of the hypotenuse AC.

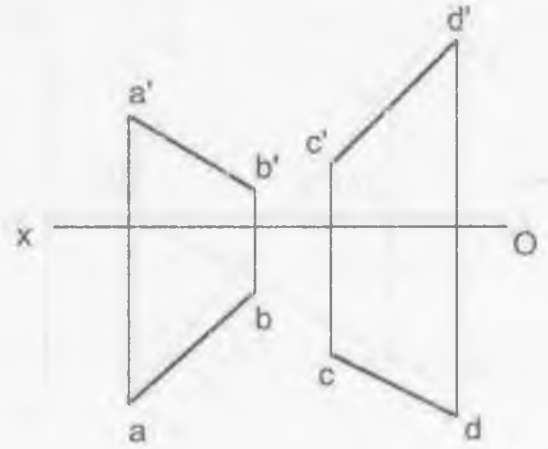


THEME: DEFINITION OF ANGLES.

Example - 1. Determine the angle between the intersecting lines AB and BC.

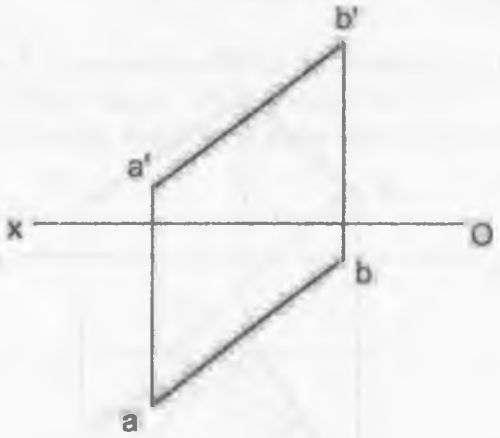


Example - 2. Determine the angle between the crossing straight lines AB and CD.

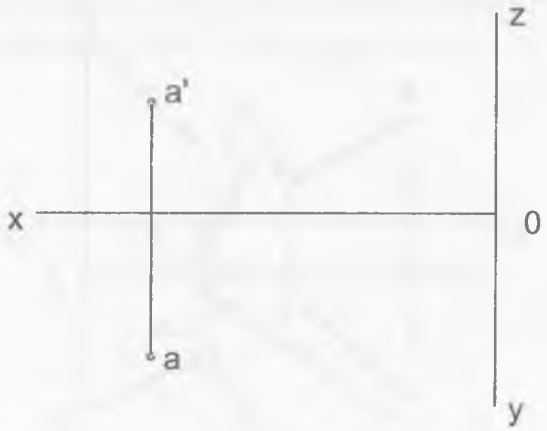


SUBJECT: DEFINITION OF ANGLES.

Example - 3. Determine the angle between the line AB and the axis OX.

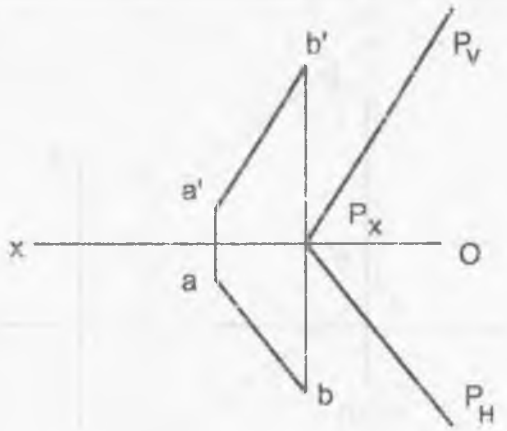


Example - 4. Through the point A to the line AB, OY axis intersecting at an angle of 600

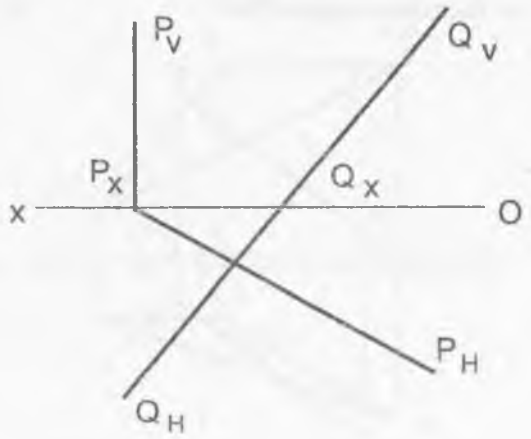


SUBJECT: DEFINITION OF ANGLES.

Example - 5. Determine the angle between the line AB and the plane P.



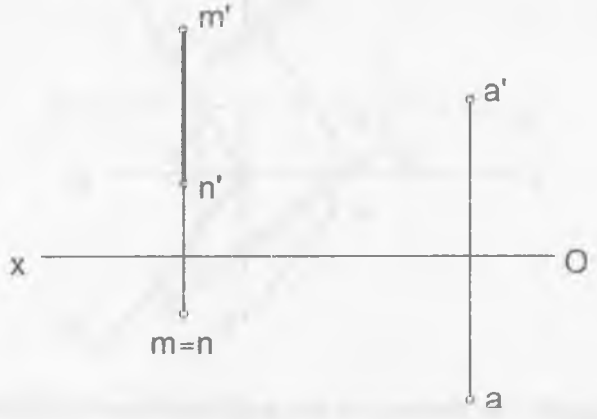
Example - 6. Determine the angle between the planes of Q and P.



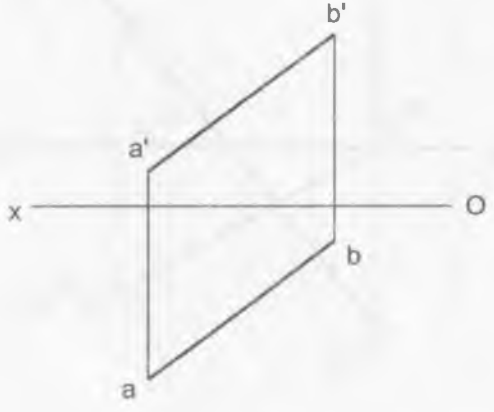
LESSON №19

SUBJECT: DEFINITION OF ANGLES.

Example 7. Through point A draw a straight line away from direct, MN at 30 mm and a component with the plane H angle 600.

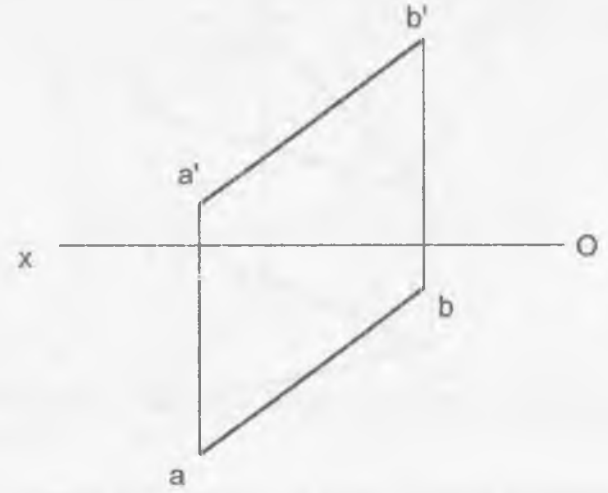


Example 8. Through the line AB to the plane P, H component of the plane angle of 600.

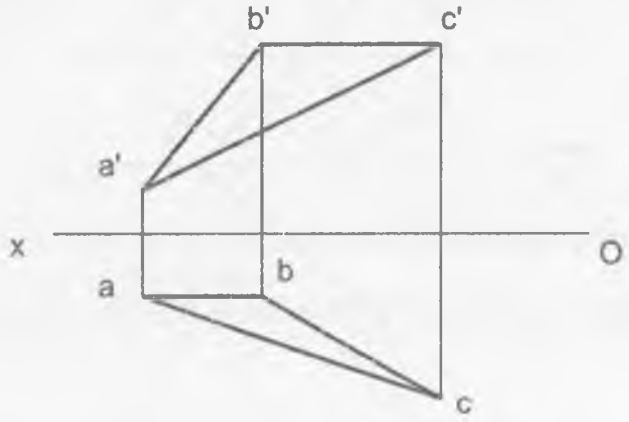


COMPLEX TASKS.

Example 1. By rotating determine the length of the segment AB.

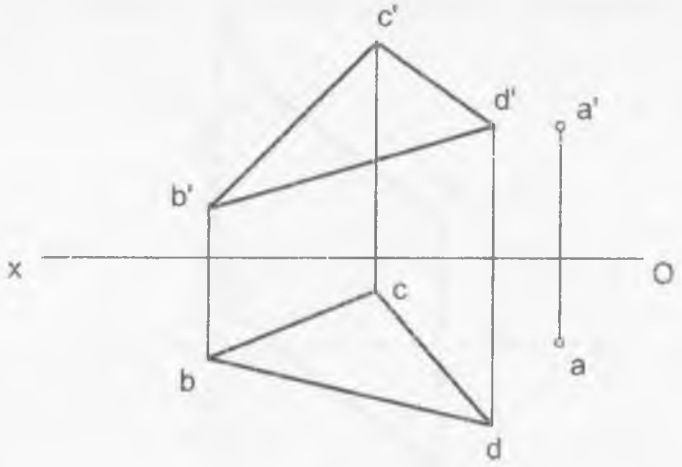


Example 2. By rotating determine native length of the triangle ABC.

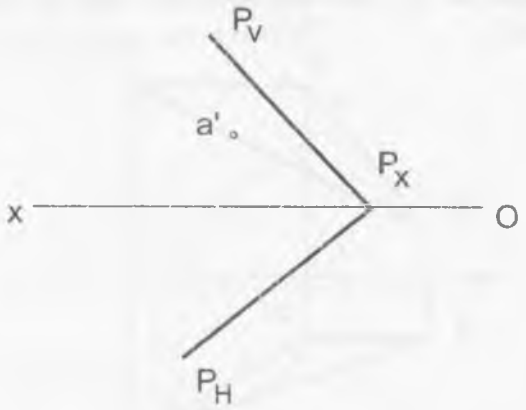


COMPLEX TASKS.

Example 3. Change the projection planes to determine the distance from point A to the plane of the triangle BCD.



Example 4. Point A plane P align with the plane N

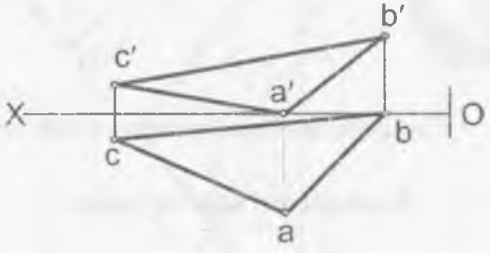


TASKS TO PREPARE FOR THE WRITTEN WORK.

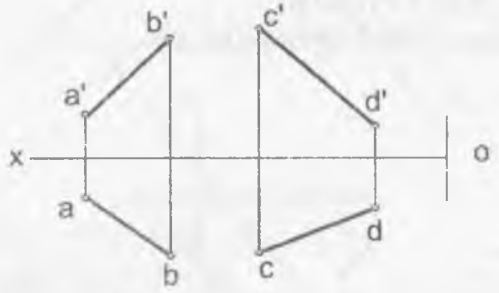
Control work №2 Ticket №2

1. Tell theorem about projecting the right angle.

2. Build a plane parallel to the plane of a given triangle ABC at a distance of 30 mm.

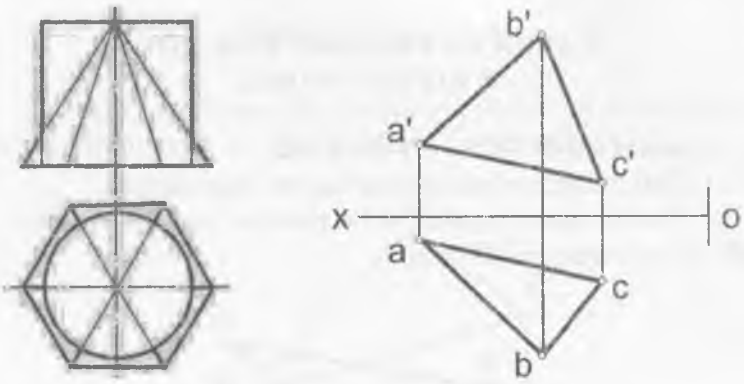


3. Determine the angle between the crossing straight lines AB and CD.



4. Construct the projections of the line of intersection of the mutual set-dimensional planes.

5. Build a straight prism with the base of the triangle ABC and a height of 50 mm.

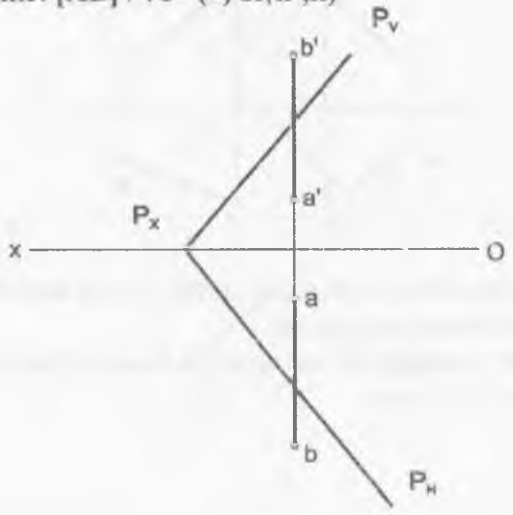


Tasks to the final written work.

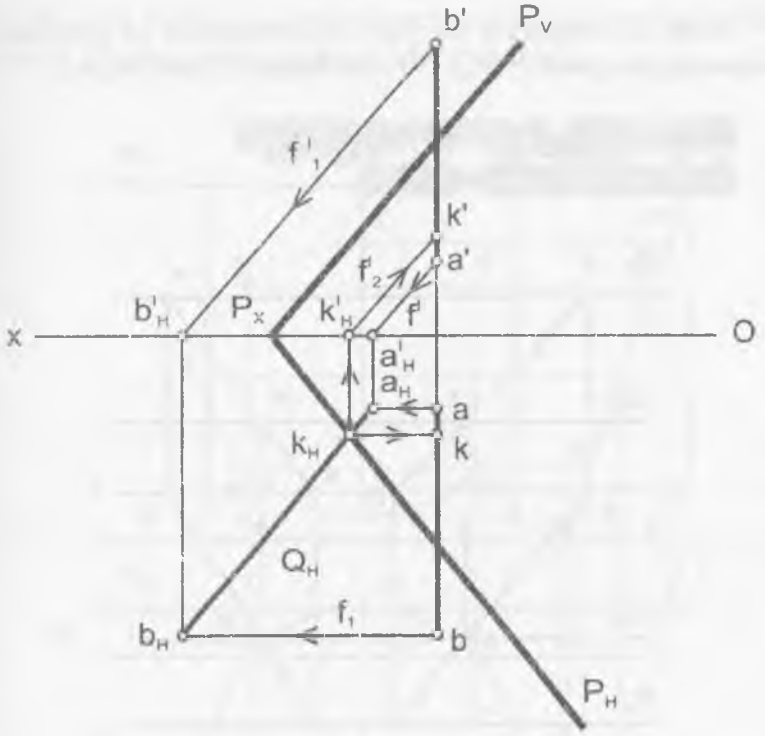
Examples of solving tasks.

1. Construct the point of intersection of the profile line of the segment [AB] with the plane in general position P (Pv, P_H).

Given: **[AB] ∧ P(Pv,Pн)**
Determine: **[AB] ∩ P=(•) K(к',к)**



Tasks to the final written work.



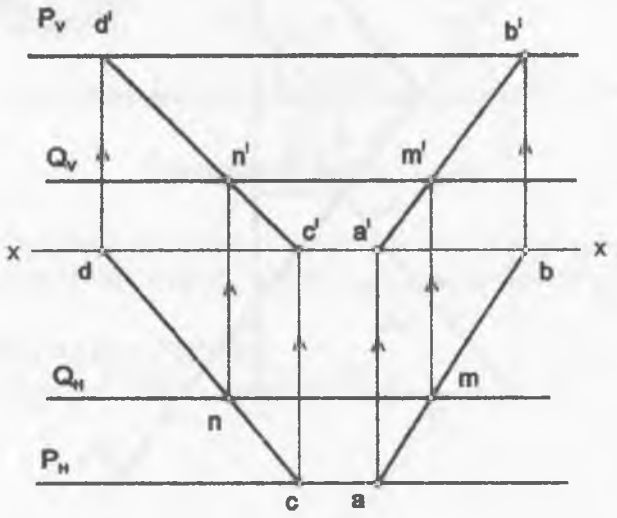
Algorithm Solution

1. $(\bullet)AB \supset f_o \;||\; P_V \wedge (\bullet)B \subset f_{o1} \;||\; P_V$
2. $f_o \cap H = A_H \wedge f_{o1} \cap H = B_H$
3. $(\bullet)A_H \cup (\bullet)B_H = [A_H B_H]$
4. $[A_H B_H] \cap P_H = (\bullet)K_H$
5. $(\bullet)K_H \subset f_{o2} \Rightarrow f_{o2} \cap [AB] = (\bullet)K \Rightarrow f_2' \cap (a'b') = K' \wedge f_2 \cap (ab) = K$

Tasks to the final written work.

Task 2. Determine the line of intersection of profiled - projecting the plane P (P_H, Pv) with frontal plane Q (Q H)

Given: P(P_H, P_V) ^ W ^ Q(Qπ) || V
Determine: (MN)=P □ Q

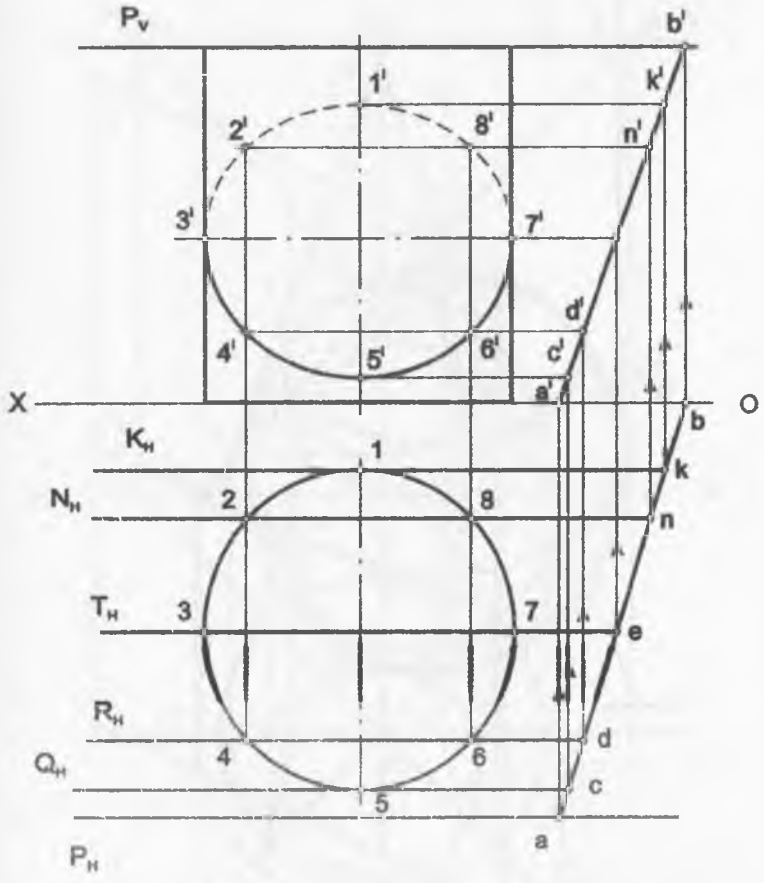


Algorithm Solution

1. [AB] ⊂ P
2. [AB] ∩ Q = [•]M
3. [CD] ⊂ P
4. [CD] ∩ Q = [•]N
5. [•]M ∪ [•]N = (MN)

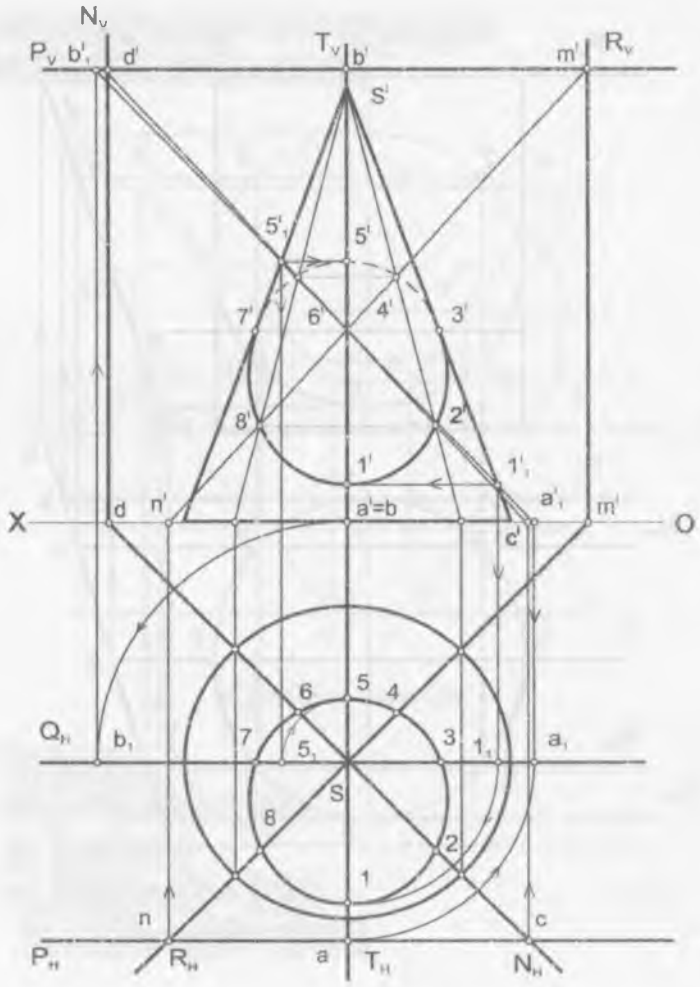
Tasks to the final written work.

Task 3. Build a line of intersection profiled - projecting the plane P (P_H, P_V) with a right circular cylinder.



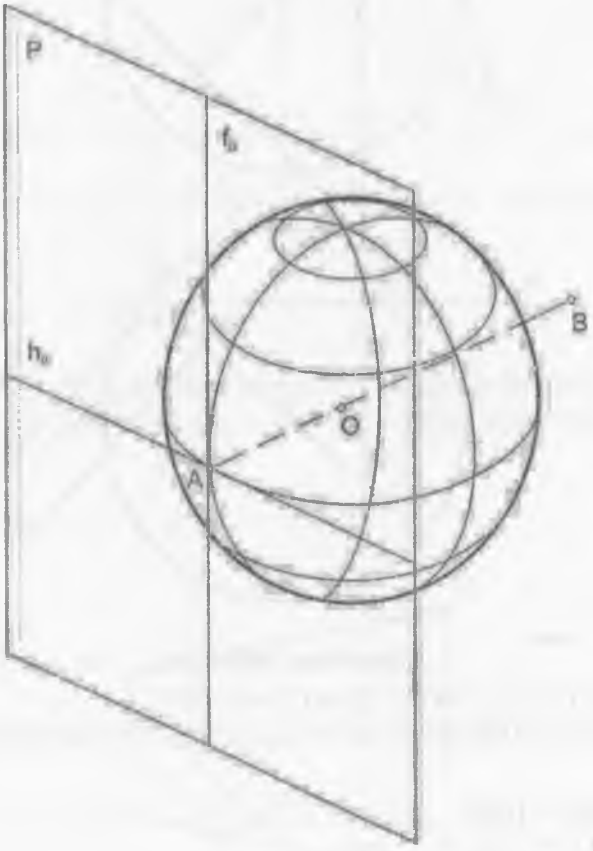
Tasks to the final written work.

Task 4. Build a line of intersection profiled - projecting the plane P (P_H , P_V) with a right circular cone.

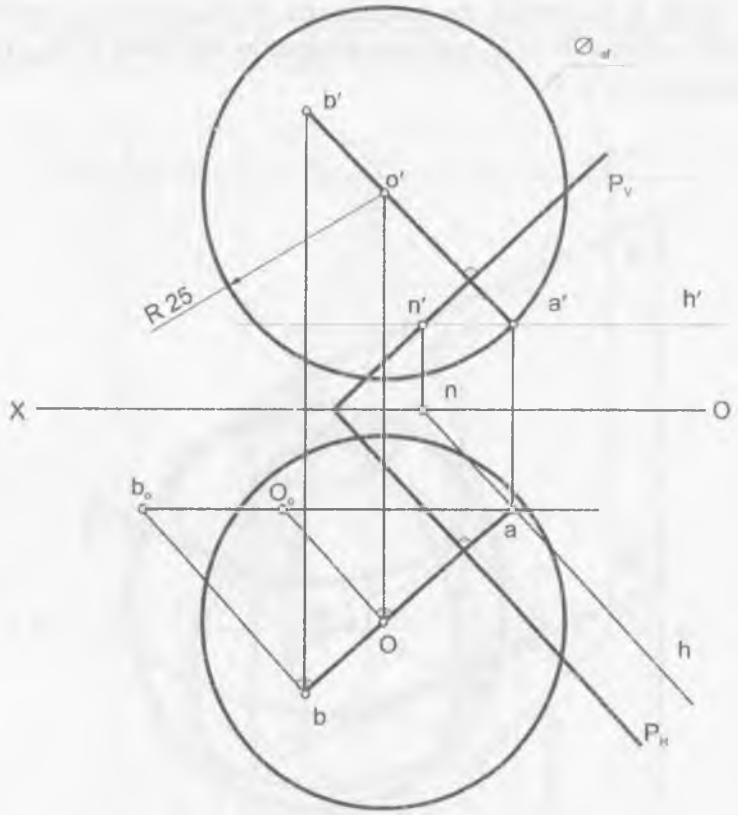


Tasks to the final written work.

Task 5. Construct the projections of the spherical surface whose radius is R = 25 mm, the tangent to the plane P (P_H, Pv) at the point A ∈ P.



Tasks to the final written work.

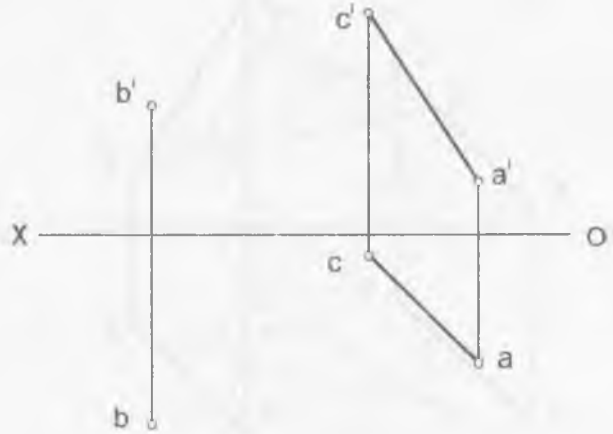


Algorithm Solution

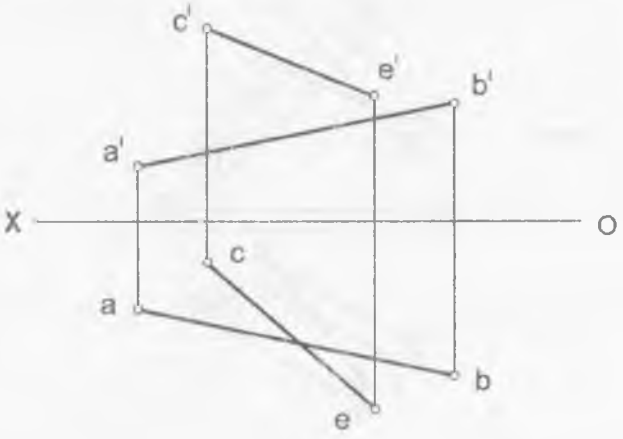
1. $(\cdot)A \subset h_o \Rightarrow (\cdot)a' \subset h' \parallel |ox) \wedge a \in h \parallel P_H$
2. $(\cdot)A \subset [AB] \perp P \Rightarrow (\cdot)a' \subset a \in [a'b'] \perp P_V \wedge (\cdot)a \subset [ab] \perp P_H \wedge \forall (\cdot) B$
3. $|aB_o| = [AB]$
4. $|aO_o| = [AB] = 25\ mm$
5. $(\cdot)O \subset \varnothing_{sf} = 25\ mm \wedge \varnothing_{sf} \cup (\cdot)A \in P$

Tasks to the final written work.

Task 6. Construct a point symmetric with respect to the straight line CA.

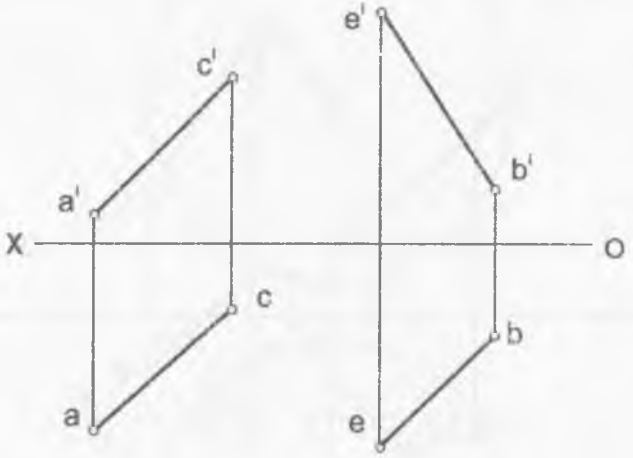


Task 7. Without the help of the profile projection, draw a straight line parallel to the x-axis and intersecting lines AB and CE.

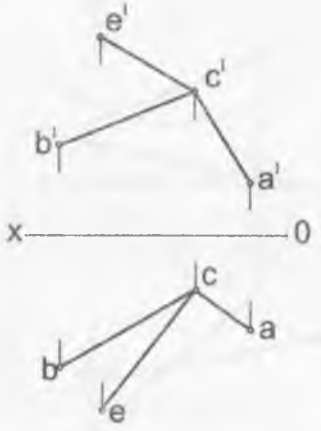


Tasks to the final written work.

Task 8. On the segment AC is on the ground, to build an isosceles triangle so that its third vertex of the direct BE.

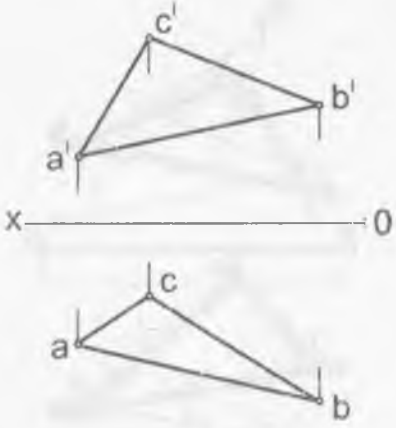


Task 9. On the line CE find a point distant from the plane ABC at the distance of 40 mm.

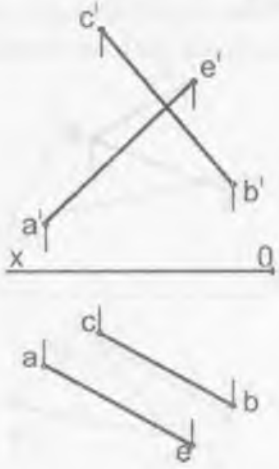


Tasks to the final written work.

Task 10. Build a prism height of 70 mm, taking as its basis the triangle ABC.

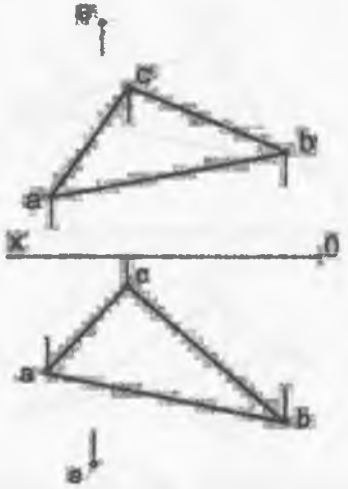


Task 11. On the segment AE, as a catheter, to construct a right triangle if the vertex of the right angle is at point A, and the third vertex on the line CB.

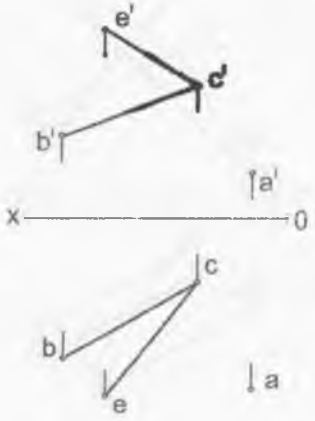


Tasks to the final written work.

Task 12. Построить точку симметричную точке **E** относительно плоскости **ABC**

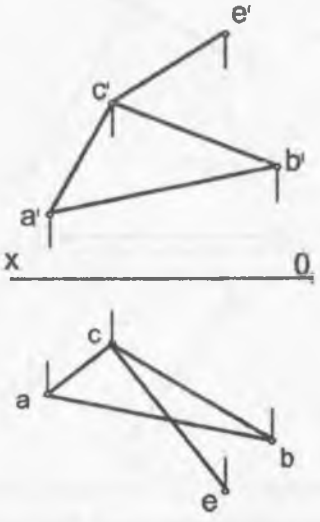


Task 13. Determine the value of the distance from point A to the plane of the ALL.

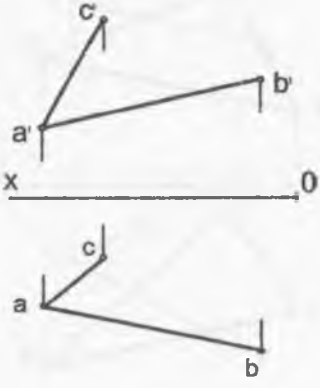


Tasks to the final written work.

Task 14. Build a rectangular projection straight CE on the plane ABC.

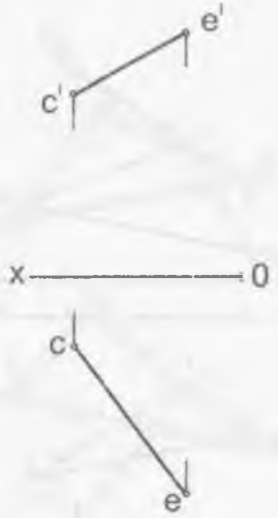


Task 15. On the segment AB is on the side, to build a diamond, taking the direction of the diagonal line CA.

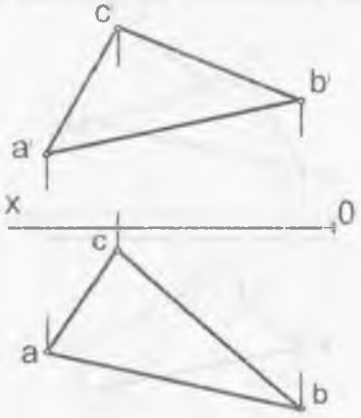


Tasks to the final written work.

Task 16. Along the line CE postpone the point E in both sides lengths of 40 mm.

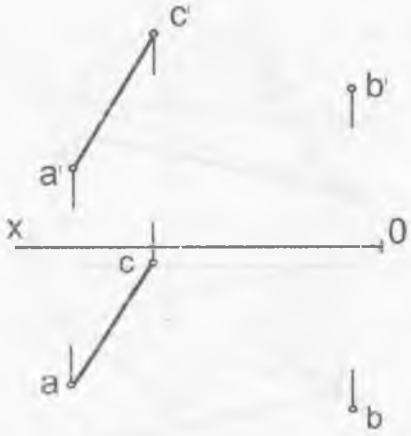


Task 17. Determine the value of the height of the triangle ABC drawn across the top of the B.

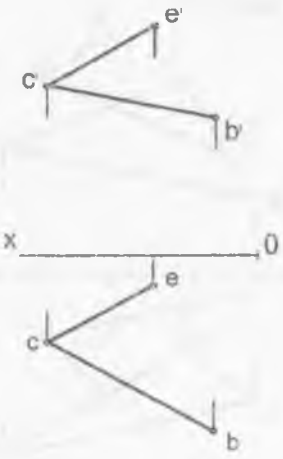


Tasks to the final written work.

Task 18. Determine the value of the distance from point B to the line CA.

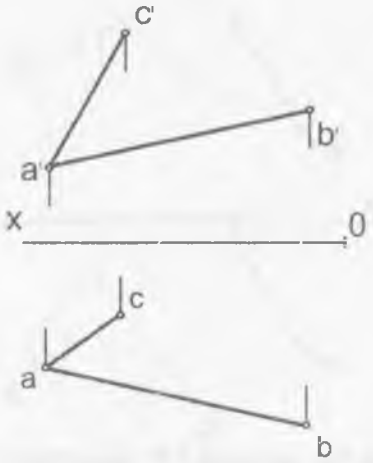


Task 19. On the segment CE as catheters, to build a right triangle if the hypotenuse is on the line ST.

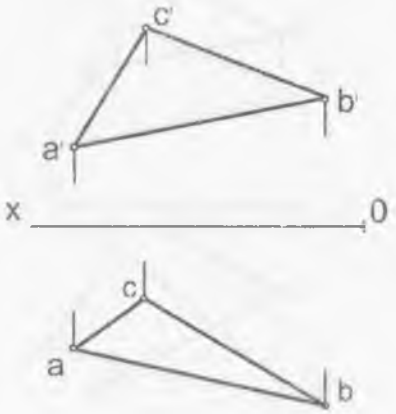


Tasks to the final written work.

Task 20. On the segment AC is on the side, to build a diamond, taking the direction of the adjacent side of the line AB.

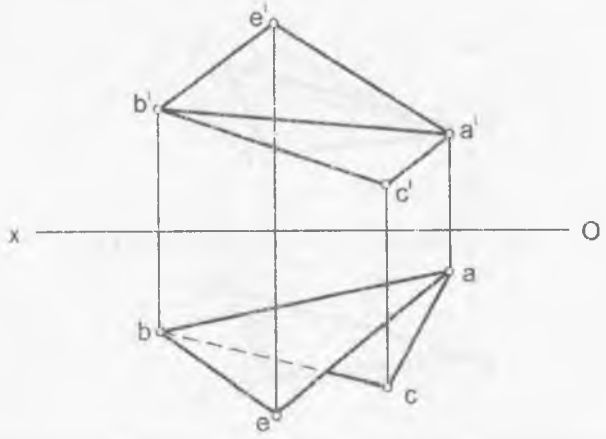


Task 21. Determine the amount of tilt angles of the plane ABC to the plane H and V.

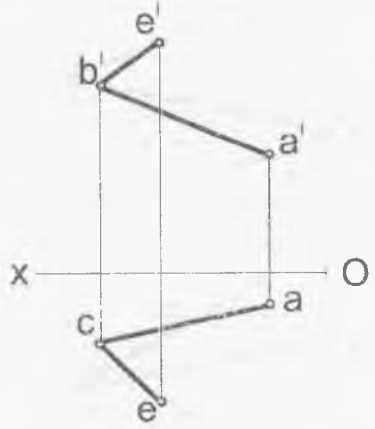


Tasks to the final written work.

Task 22. By replacement determine value of the angle between the planes ABC and ABE.

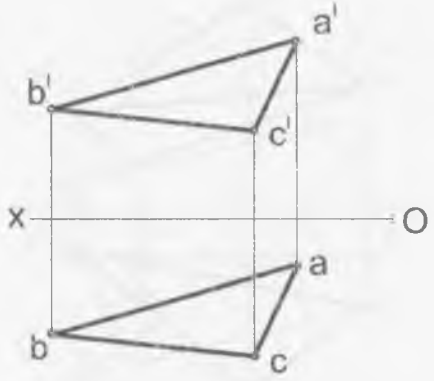


Task 23. By replacement build the center and the junction point of the angle sides AVE arc of a circle of radius of 15 mm.

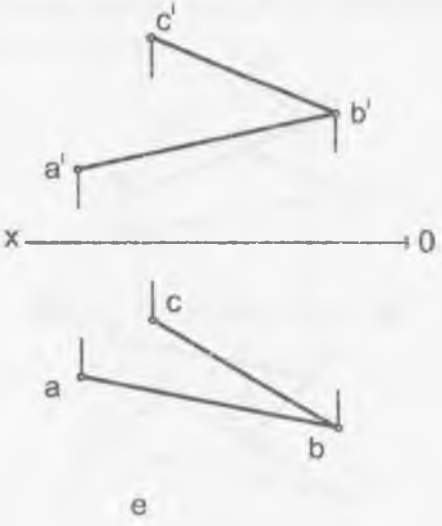


Tasks to the final written work.

Task 24. By rotation build a center of the circle inscribed in the triangle ABC.



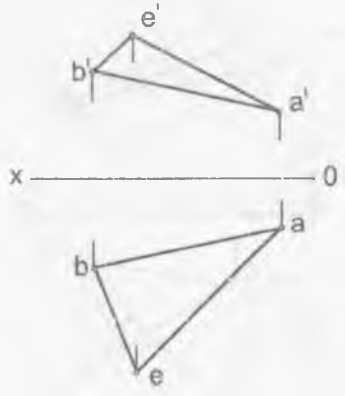
Task 25. By replacement construct a plane at a distance of 30 mm from the plane ABC.



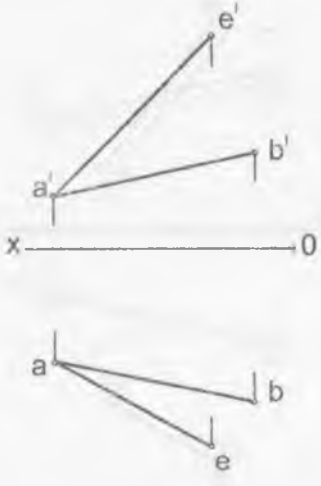
e

Tasks to the final written work.

Task 26. By replacement build a true view of the triangle ABE.

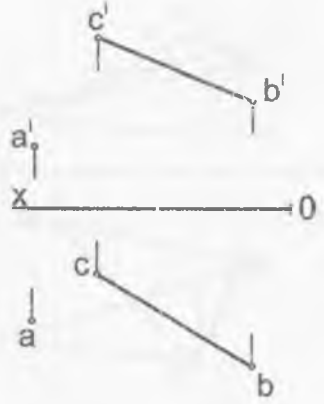


Task 27. By replacement construct an isosceles triangle, taking the side of his segment AB, and for its direct base line AE.

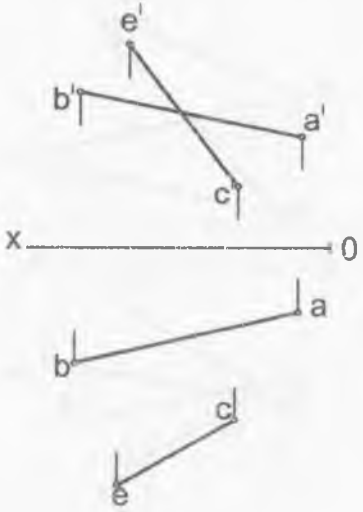


Tasks to the final written work.

Task 28. By rotating determine the distance from point A to direct BC.

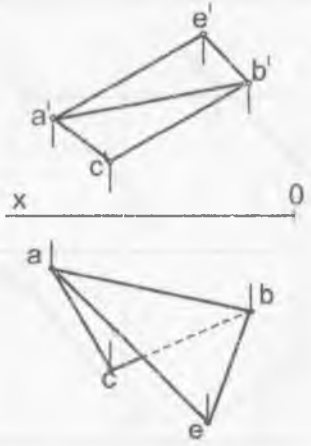


Task 29. By replacement determine the distance between the skew lines AB and CE.

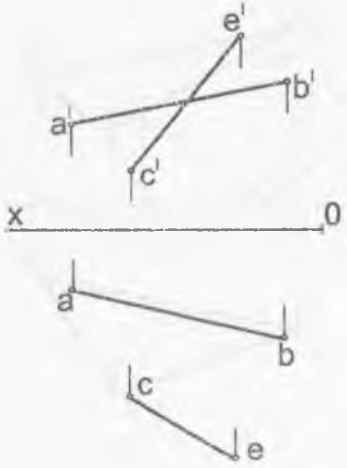


Tasks to the final written work.

Task 30. By replacement construct a straight line on a remote 15 mm from the edges of the angle at the edge AB.

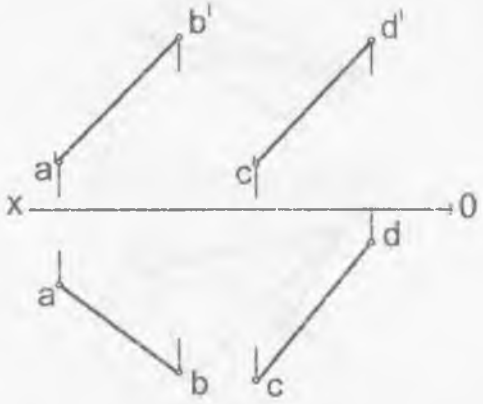


Task 31. By replacement on the line AB to find points distant from the direct CE 40 mm.

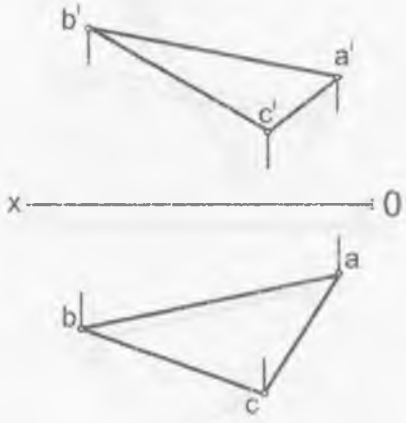


Tasks to the final written work.

Task 32. Given skew lines AB and CD. Way to build a direct replacement of the parallel CD and keeping up with her at a distance of 40 mm, as well as crossing the line AB.

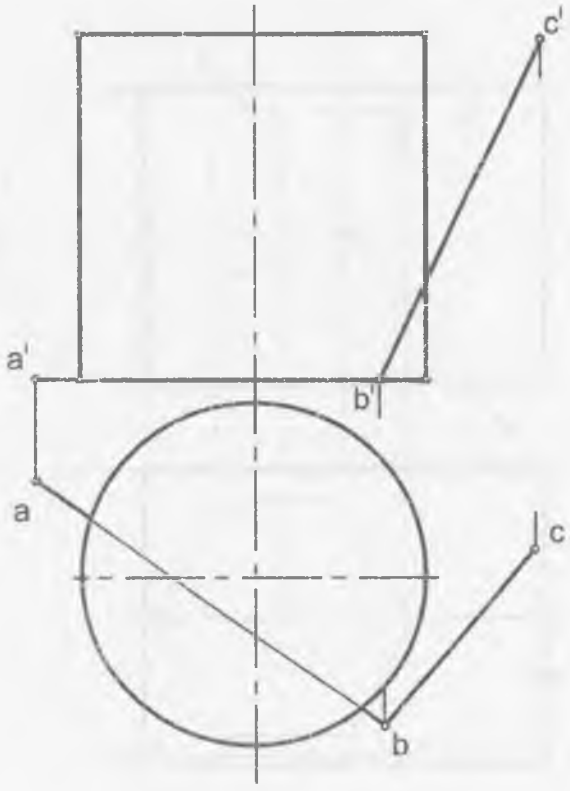


Task 33. By rotating construction the center of the circle circumscribed about the triangle ABC.



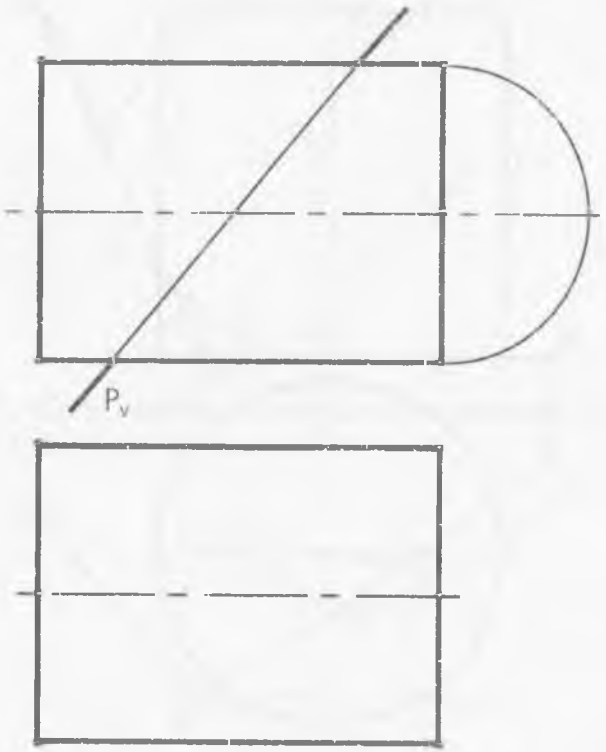
Tasks to the final written work.

Task 34. Construct the projections of the line of intersection of the surface relative to the plane ABC. The plane was considered transparent.



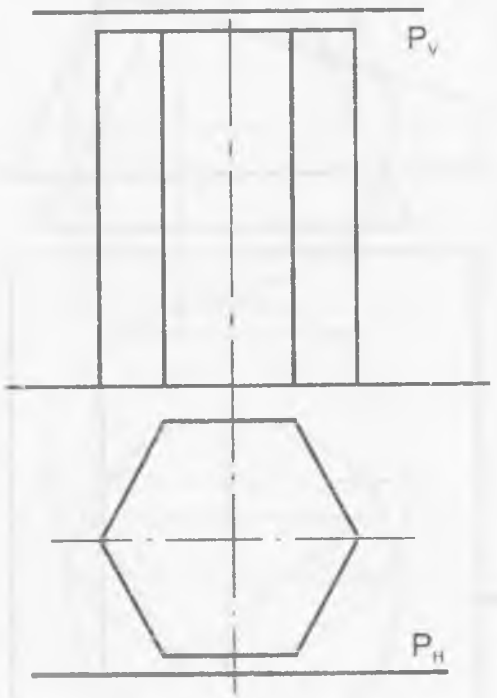
Tasks to the final written work.

Task 35. Build a plan view and a true cross-sectional view of the surface with the plane P. The plane is considered transparent.



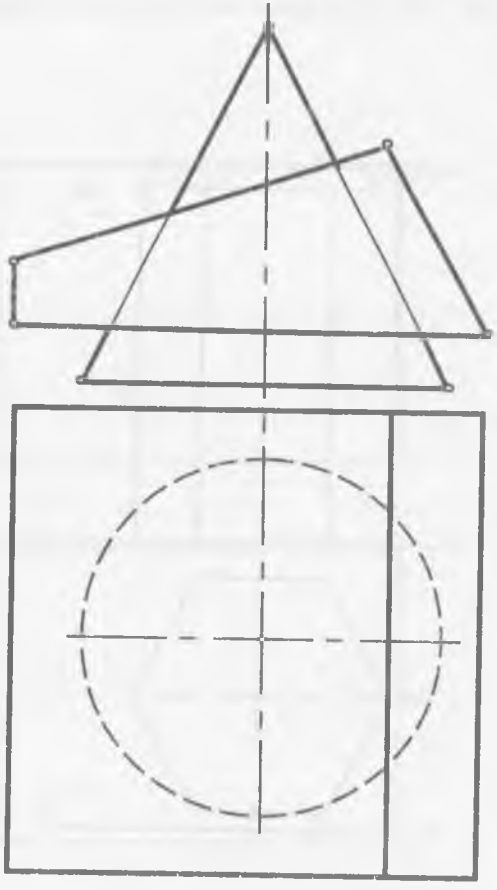
Tasks to the final written work.

Task 36. Without the help of the profile projection, build the core of the projection of the intersection of the surface with the plane P (PH, PV). The plane was considered transparent.



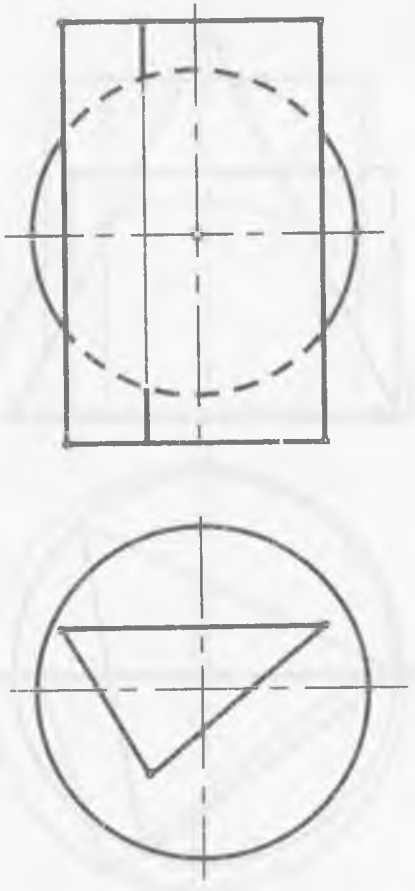
Tasks to the final written work.

Task 37. Construct the projections of the line set of mutual crossing surfaces.



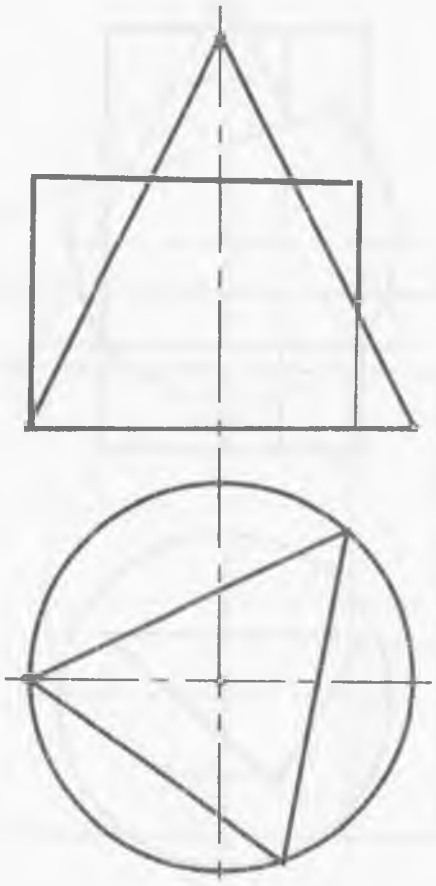
Tasks to the final written work.

Task 38. Construct the projections of the line set of mutual crossing surfaces.



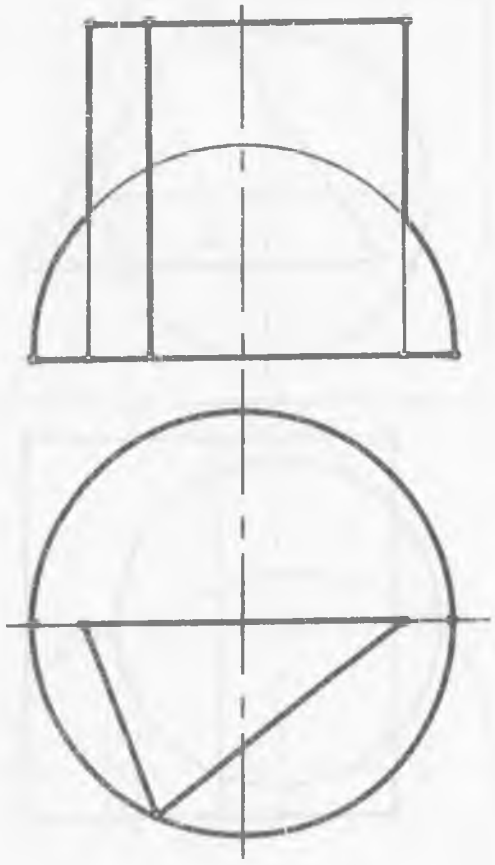
Tasks to the final written work.

Task 39. Construct the projections of the line set of mutual crossing surfaces.



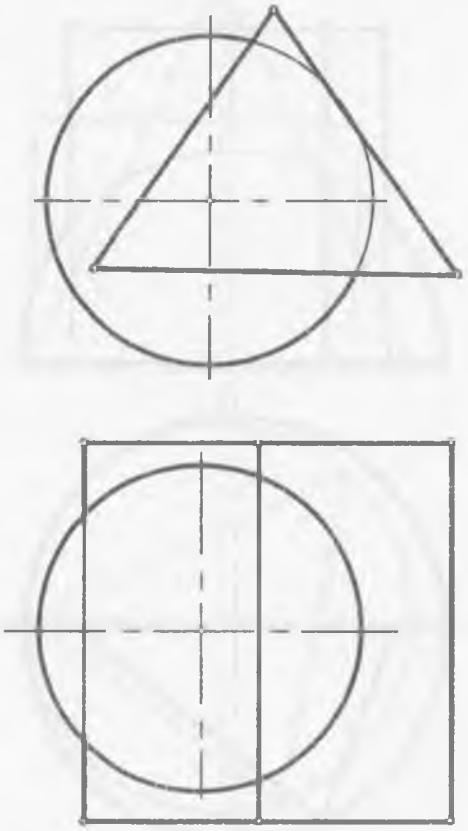
Tasks to the final written work.

Task 40. Construct the projections of the line set of mutual crossing surfaces.



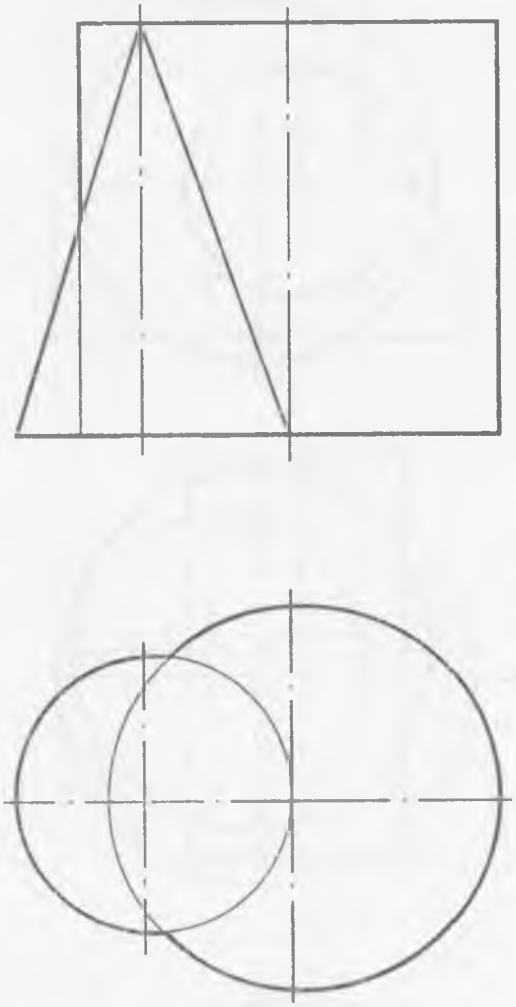
Tasks to the final written work.

Task 41. Construct the projections of the line set of mutual crossing surfaces.



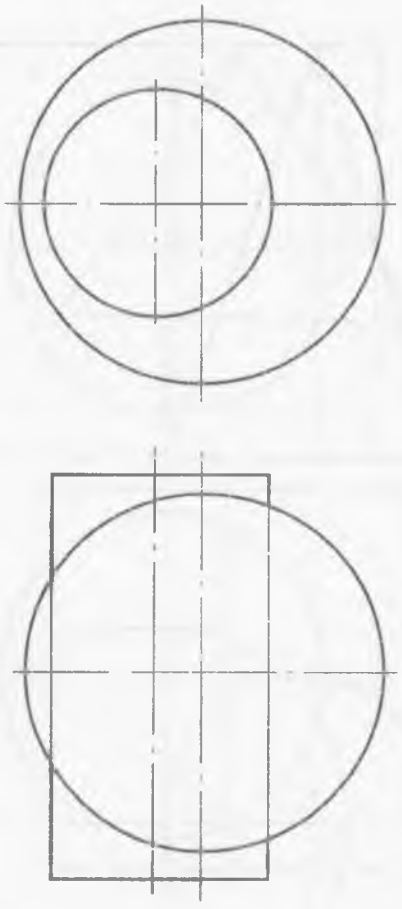
Tasks to the final written work.

Task 42. Construct the projections of the line set of mutual crossing surfaces.



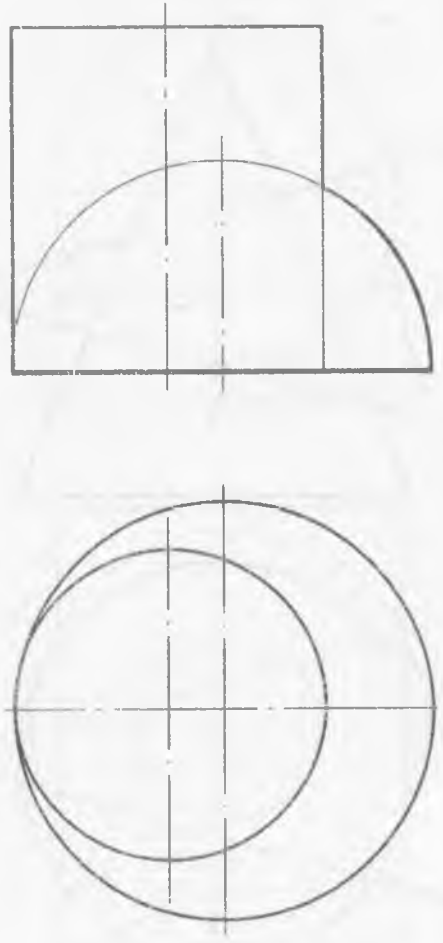
Tasks to the final written work.

Task 43. Construct the projections of the line set of mutual crossing surfaces.



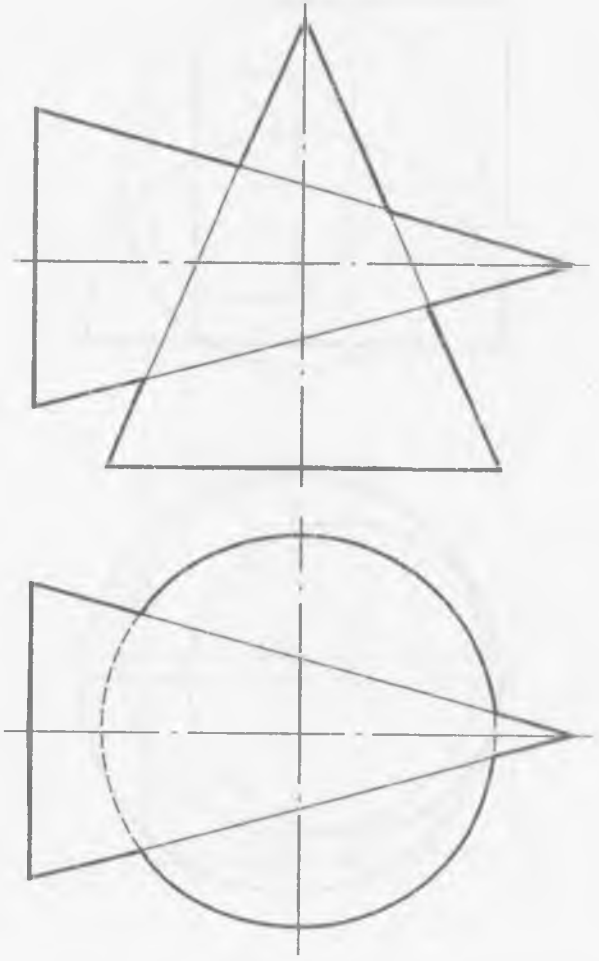
Tasks to the final written work.

Task 44. Construct the projections of the line set of mutual crossing surfaces.



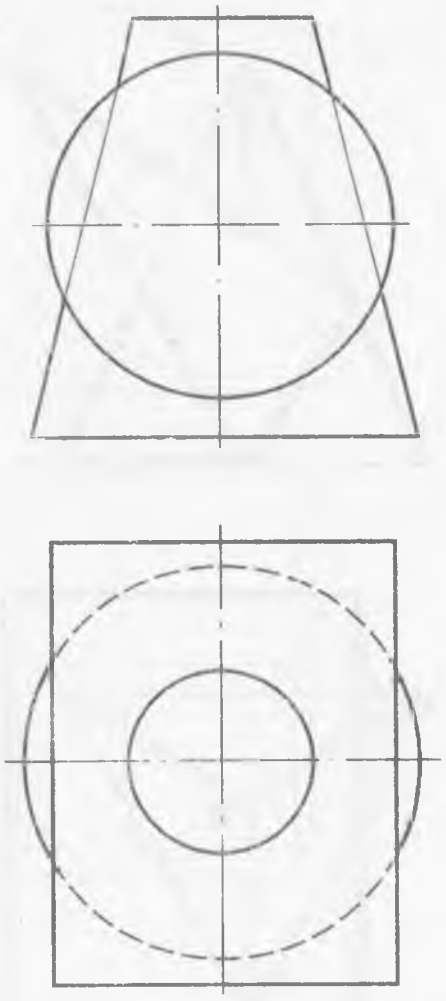
Tasks to the final written work.

Task 45. Construct the projections of the line set of mutual crossing surfaces.



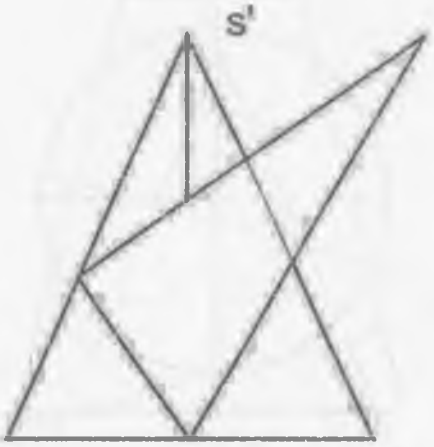
Tasks to the final written work.

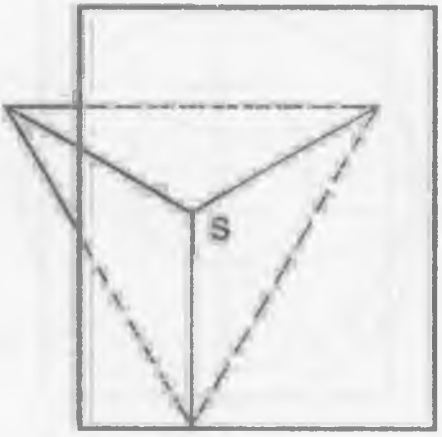
Task 46. Construct the projections of the line set of mutual crossing surfaces.



Tasks to the final written work.

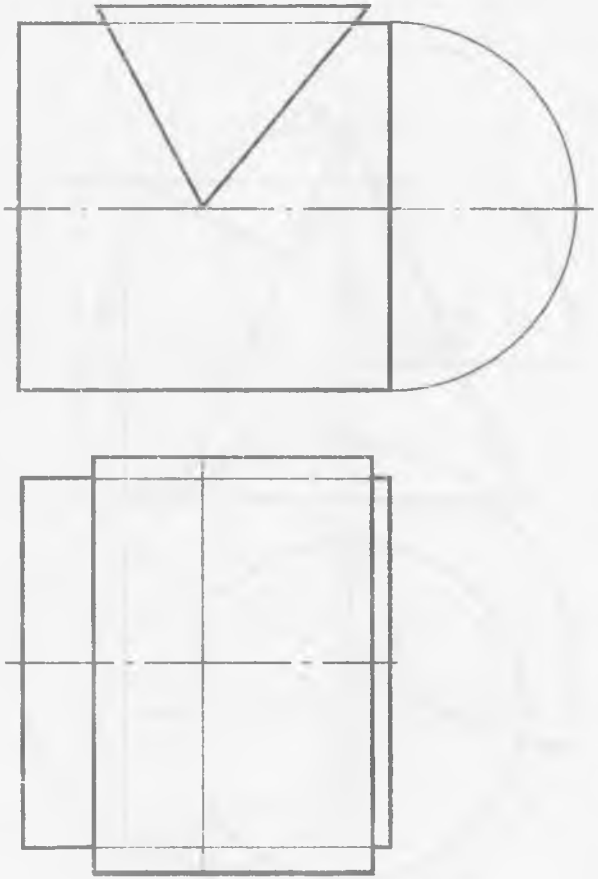
Task 47. Construct the projections of the line set of mutual crossing surfaces.





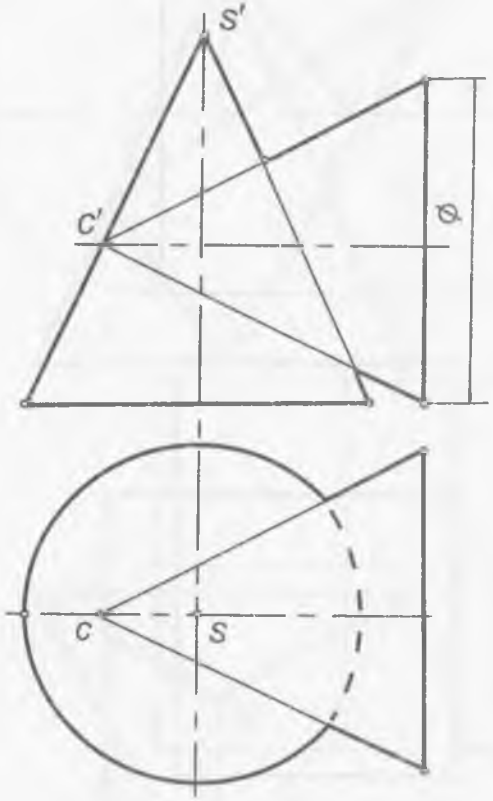
Tasks to the final written work.

Task 48. Construct the projections of the line set of mutual crossing surfaces.



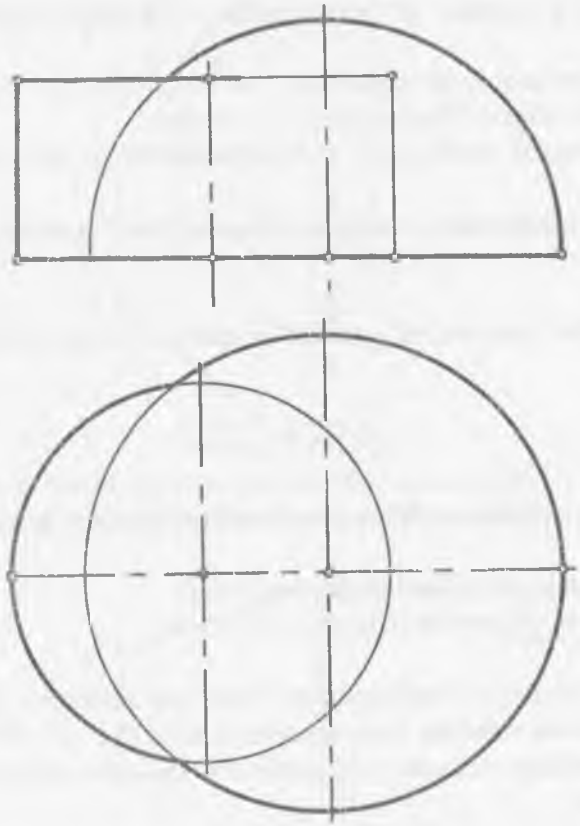
Tasks to the final written work.

Task 49. Construct the projections of the line set of mutual crossing surfaces.



Tasks to the final written work.

Task 50. Construct the projections of the line set of mutual crossing surfaces.



Olympiad Tasks

The criterion of ranking points to the problems of "Olympics" to "Descriptive Geometry and Engineering Graphics", held Tashkent State Technical University.

I - In descriptive geometry (two goals)

1. The solution of the problem of the spatial schema. - 4 points
2. The sequence (algorithm) solving problems. - 4 points
3. Solution of the problem. - 20 points
4. Stroke drawing on the requirements of the guests - 2 points
5. Alphanumeric designations task from number 3, 5. - 2 points

6. The number of possible solutions of the problem. - 3 points

35h2 = 70 points

II. According to the engineering drawing (one goal)

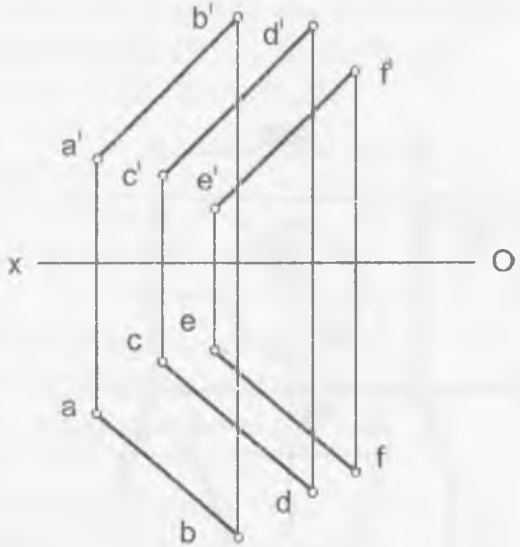
1. For a given front projection build
3 types of geometric body. - 15 points

2. Cumulative Performance of cuts and sections. - 5 points
3. Stroke drawing lines according to GOST. - 5 points
4. making necessary the geometric dimensions of the body - 5 points

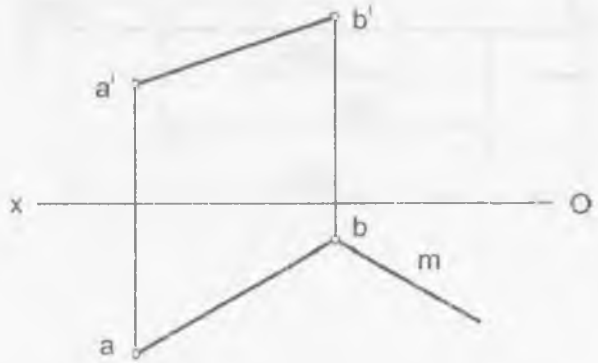
30 points
TOTAL: 100 points

Tasks Olympiad

Task 1. Given three parallel lines AB, CD and EF. Build a fourth parallel line MN to data and equidistant from them.

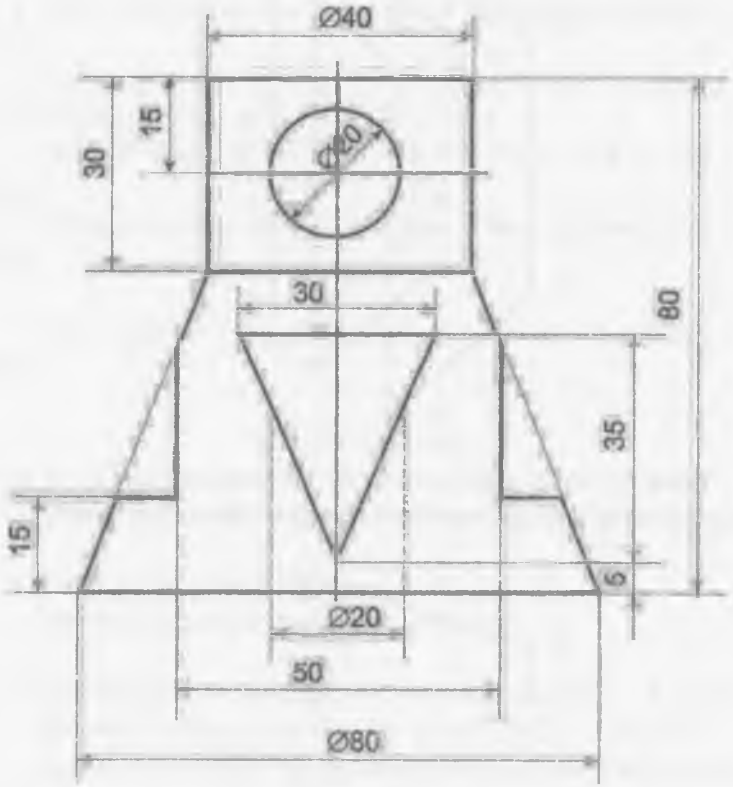


Task 2. Build a projection of the square ABCD, if given projections of AB and the direction m of the second party.



Tasks Olympiad

Task 3. According front projection geometry of the body to build its profile and horizontal projection. Run the required sections and cross sections and display an appropriate size.



Task for self-education

I. Projecting the geometric shapes

Task 1. Build a horizontal and frontal projections of the given coordinates.**A**(20;25;10); **B**(15;-15;-20); **C**(-10;20;15); **D**(25;10;-25); **E**(10;-25;25)

Task 2. Given point A (x = 20, y = 15, z = 10)

Construct a diagram of point B, A symmetrical about a horizontal plane of projection.

Task 3. Given point A (x = 25, y = -15, z = 15)

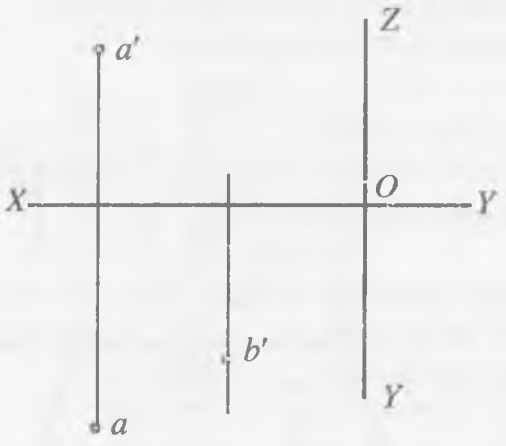
In terms of diagrams to build a symmetric A relative frontal plane of projection.

Task 4. Given point A (x = 10, y = -20, z = -25)

Construct a point in the diagram that is symmetric about the axis X. A

Task for self-education

Task 5. Given Point A and point B front view in which octant point in space is the distance between A and B is equal to 30 mm.



Task 6. Construct the projections of AB line. If the line:

a) general provisions;

b) parallel to the horizontal plane of projection;

c) paraliel to the frontal plane of projection;

d) perpendicular to the horizontal plane of projection;

e) perpendicular to the frontal plane of projection:

f) is perpendicular to the profile plane of projection;

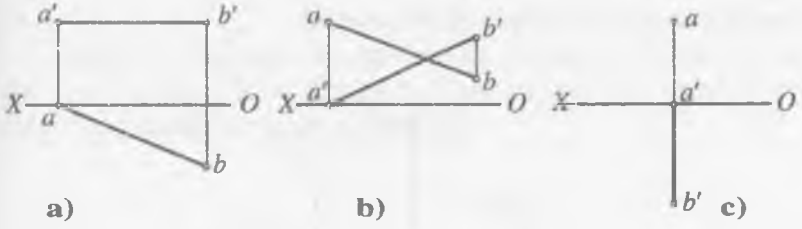
Task for self-education

Task 7. Read diagrams of AB (fill in the missing)

1) [AB] is (?) Quadrant is parallel (?) Plane projection abuts the end of the A (?) Projection plane (see a.);

2) [AB] is in (?) Quadrant, the end rests against the A (?) Projection plane (see Fig b.);

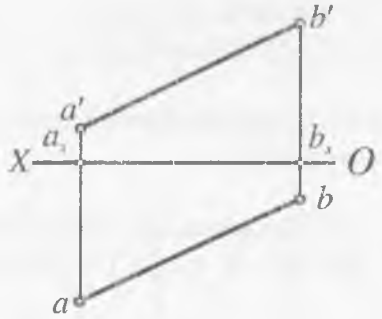
3) [AB] is (?) Quadrant is perpendicular (?) Plane projection abuts the end of the A (?) Projection plane (see figure c.);



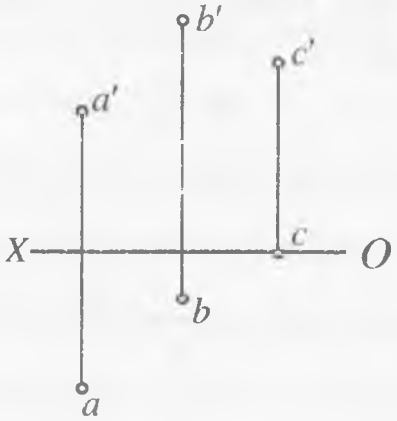
Task for self-education

II. How to convert orthogonal projection

Task 8. Replacing the projection plane translate [AB] in a position parallel to the frontal plane of projection.

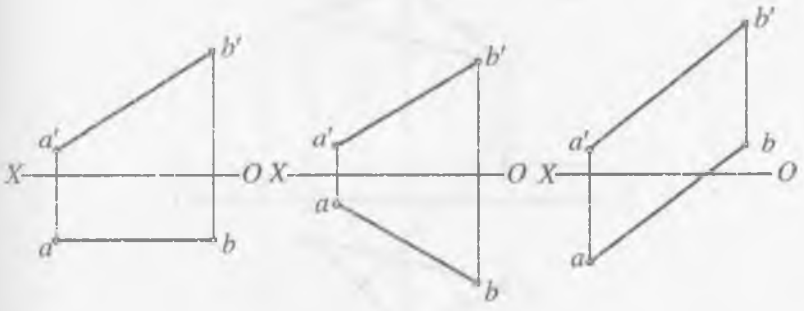


Task 9. Construct the projections of the points A, B, C in the new system of planes of projection.

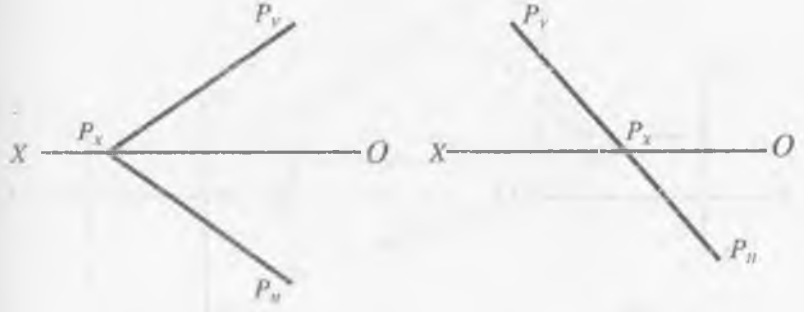


Task for self-education

Task 10. Replacing the projection planes translate [AB] in the horizontal projecting position.

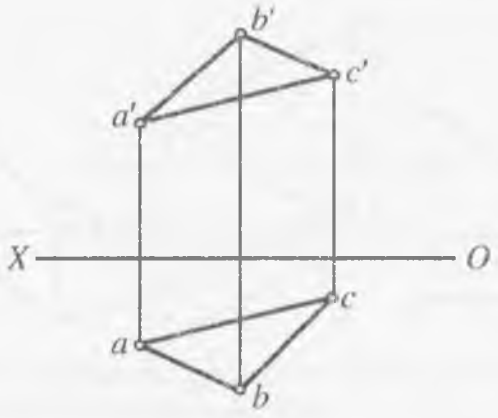


Task 11. Replace the projection plane and build a new trace of the plane P so that in the new system, the plane P has taken horizontally projecting position.



Task for self-education

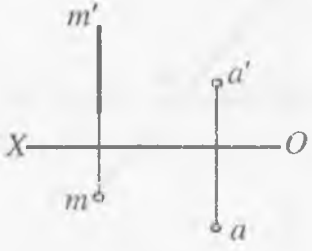
Task 12. Определить заменой плоскостей проекции положение центра тяжести треугольника **ABC**.



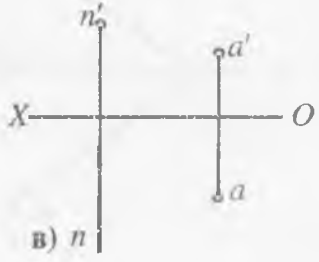
Task 13. Rotate point A on the angle at 90 degrees clockwise direction:

a) projecting horizontally around the axis m;

c) around the axis projecting frontally n;



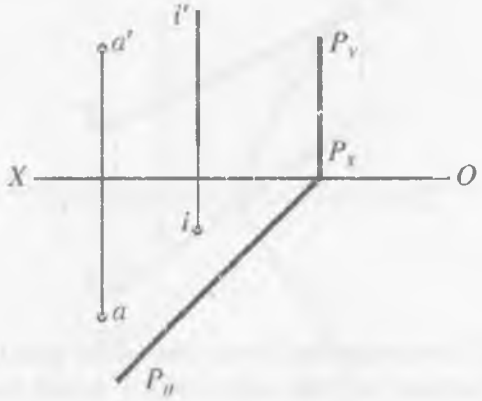
а)



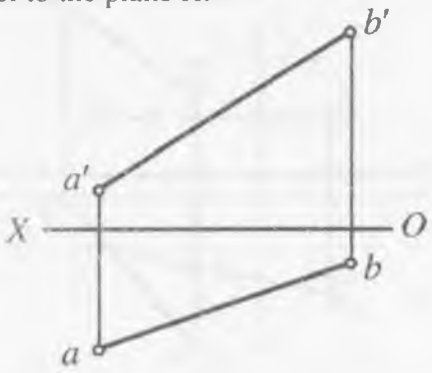
в) n

Task for self-education

Task 14. Rotate around the axis of the point A i to align with the plane P.

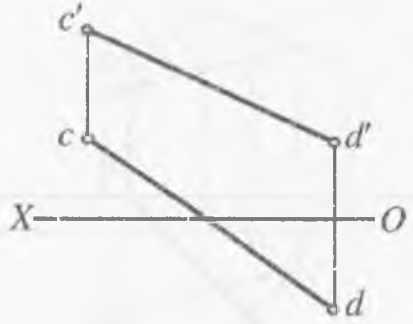


Task 15. Rotation around the axis of the transfer [AB] in a position parallel to the plane H.

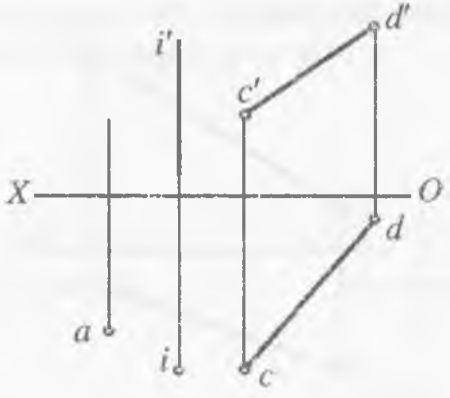


Task for self-education

Task 16. Rotation around the axis of the transfer [CD] in a position parallel to the plane of the V.

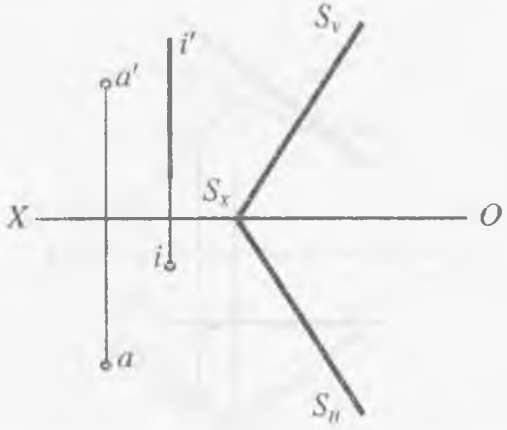


Task 17. Determine the front view of the point A, knowing that rotation around a given axis point i would be on the line CD.

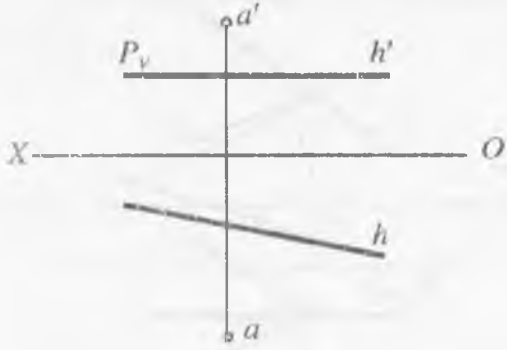


Task for self-education

Task 18. Rotate about an axis point A I to align with the plane S.

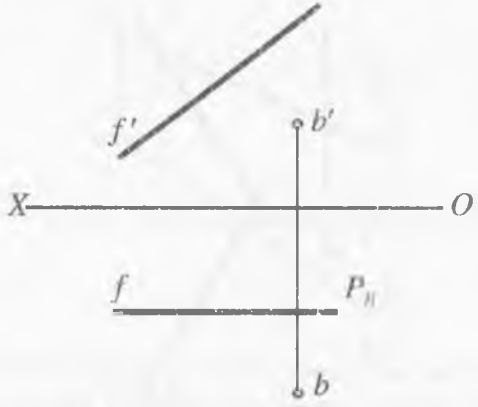


Task 19. Turn around point A horizontal h0 **h_0(h,h')** alignment with the horizontal plane P.

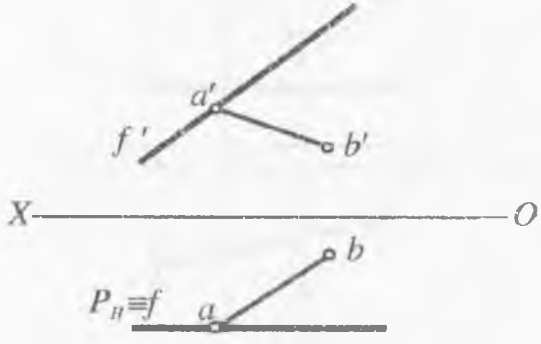


Task for self-education

Task 20. Turn around point in the frontal f0 $f_0(f,f')$ to align it with the frontal plane P.

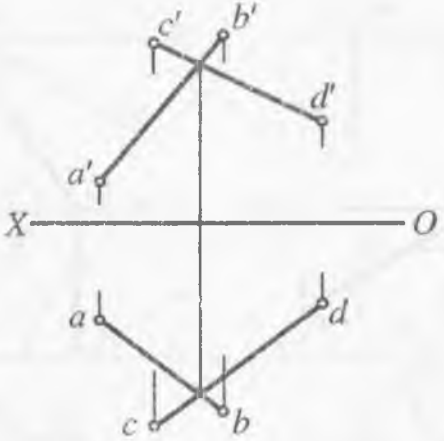


Task 21. Turn the [AB] around the frontal $f\ (A \in f_0)$ to align it with the frontal plane P.

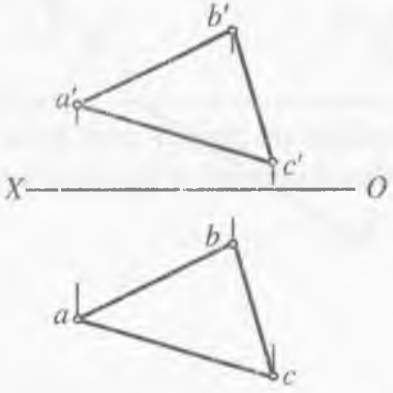


Task for self-education

Task 22. The plane defined intersecting lines AB and CD, turn it around to the position of the frontal, frontal plane parallel projection.

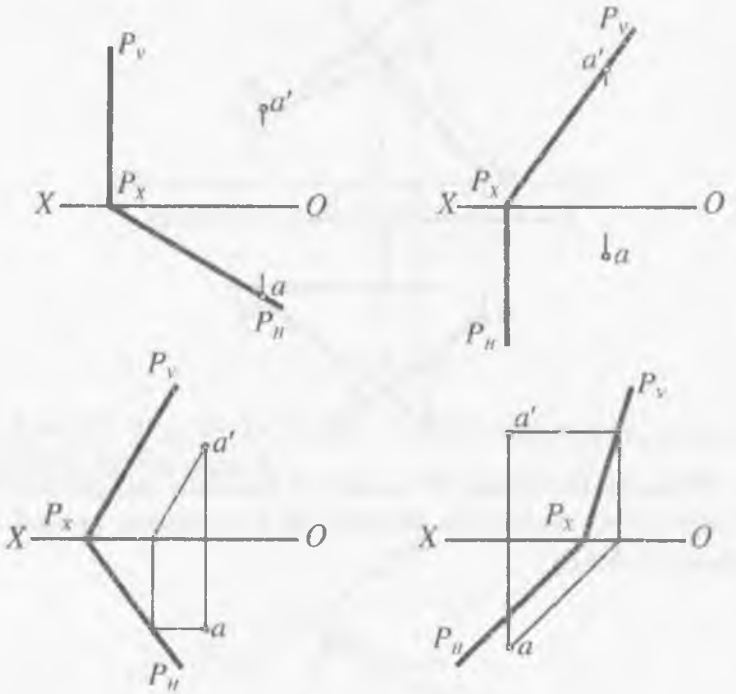


Task 23. Determine the center of the circle inscribed in the triangle ABC. Solve the problem of the rotation around the horizontal Δ ABC.



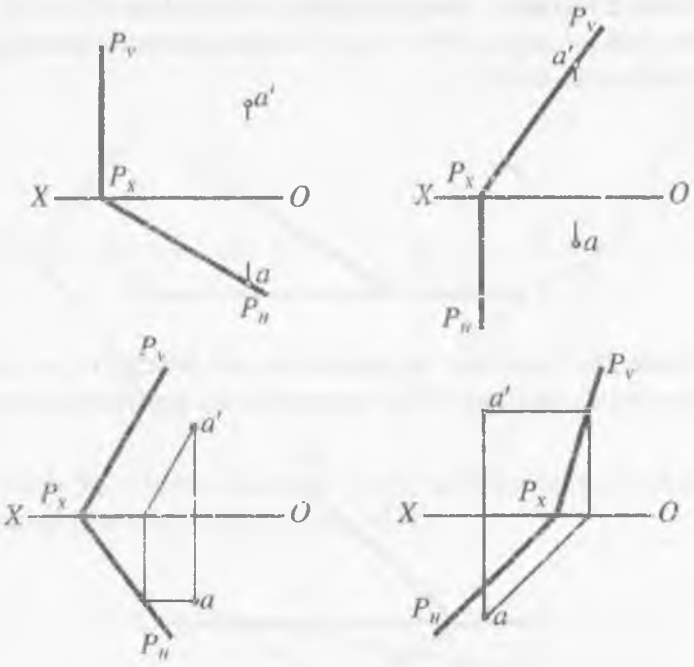
Task for self-education

Task 24. Combine the plane P with the horizontal plane of projection and find the combined position of the point **A∈P**

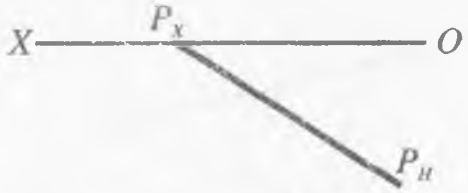


Task 25. Combine the plane P with front projection plane and find the combined position of the point **A∈P**

Task for self-education

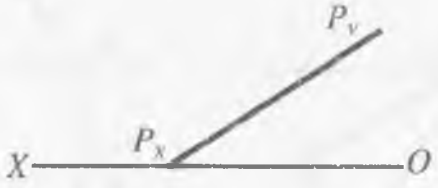


Task 26. Build a front track of the plane P, if it is known that the angle in the space between the tracks of PH and PV is equal to 45 °.

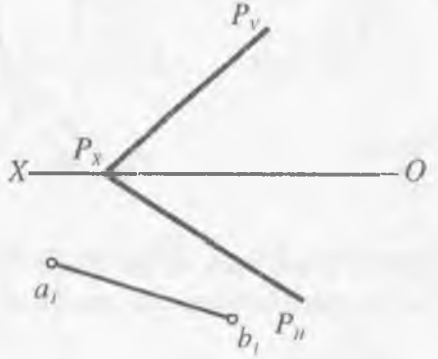


Task for self-education

Task 27. Build a horizontal trace of the plane P, if it is known that the angle in the space between the horizontal and the front tracks is 60 °.

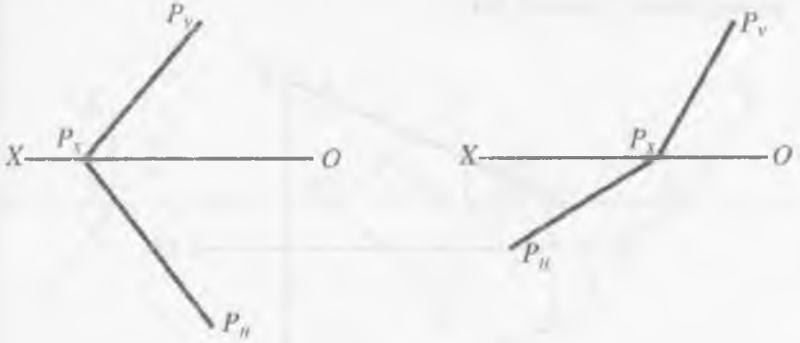


Task 28. Construct the projections of **AB⊂P**, if you know the combined position of the segment in the horizontal plane.

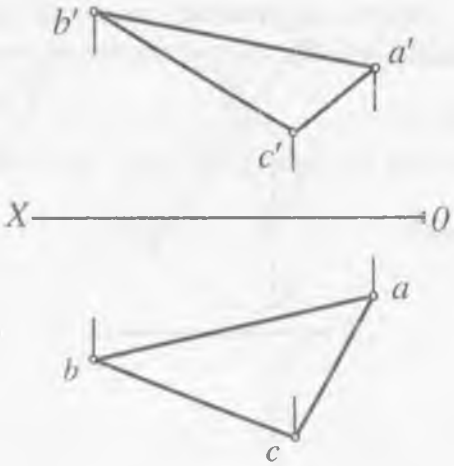


Task for self-education

Task 29. Construct a plane generic circle R = 30 mm, tangential to its pursuit.



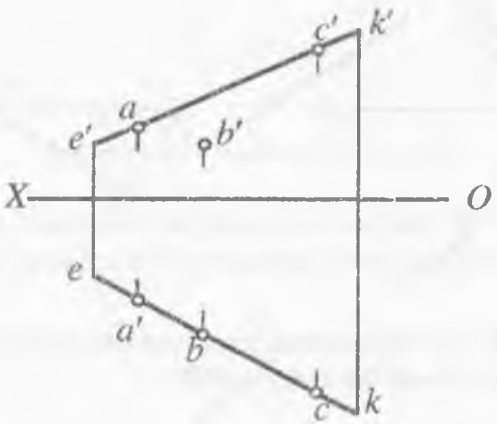
Task 30. By replacement construct the center of the circle circumscribed about the triangle ABC.



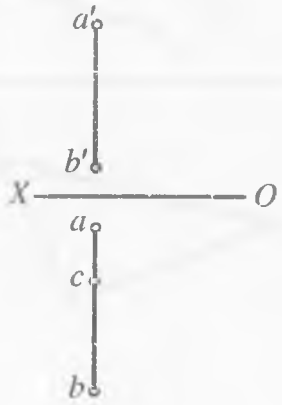
Task for self-education

III. Positional tasks.

Task 31. Определить, какая из заданных точек **A**, **B**, **C** принадлежит прямой **KE**.

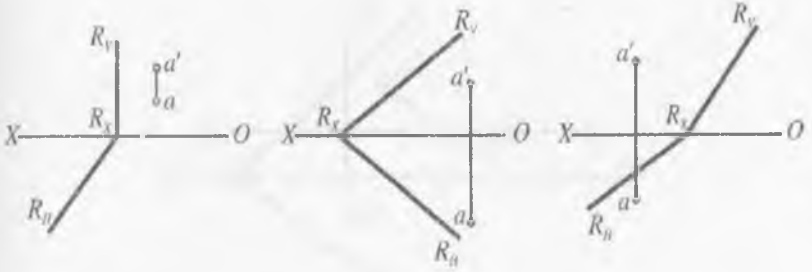


Task 32. Найти на прямой, заданной отрезком **AB**, проекции точки **C∈[AB],** если известна её горизонтальная проекция.

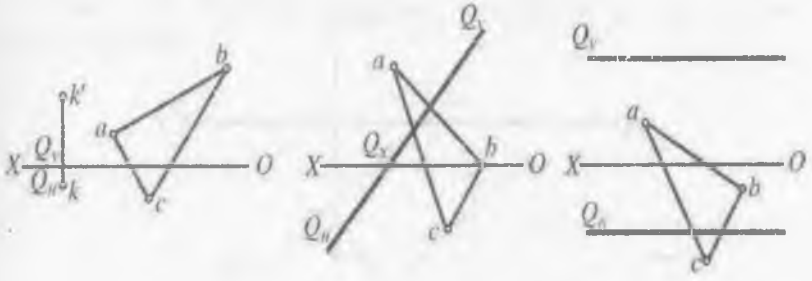


Task of self-education

Task 33. Даны точка **A** и плоскость **R**. Выяснить принадлежит ли точка **A** заданной плоскости **R**.

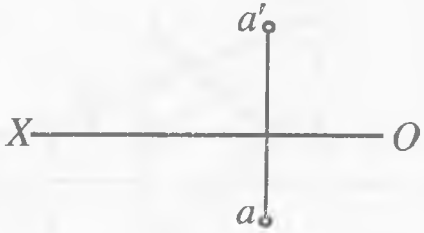


Task 34. According to this plan view **ΔABC∈Q** to build his front view.

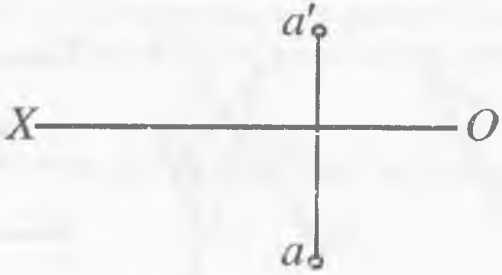


Task of self-education

Task 35. Through point A to arbitrary horizontally projecting plane.

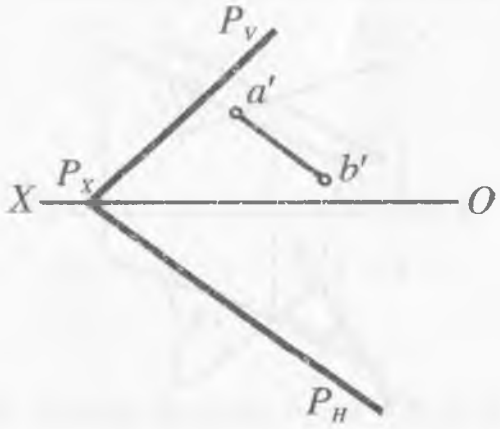


Task 36. Through a point A to a plane parallel to the x axis.

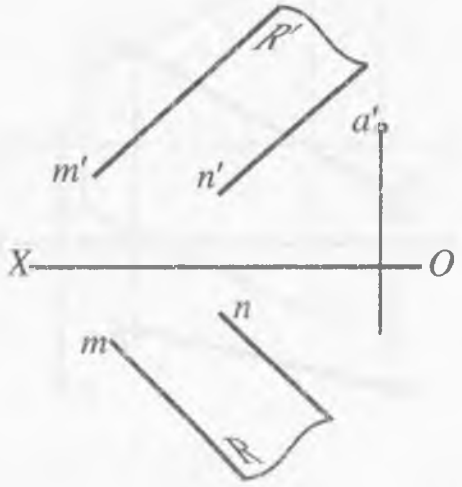


Task for self-education

Task 37. Build a plan view of the line AB owned the plane P.

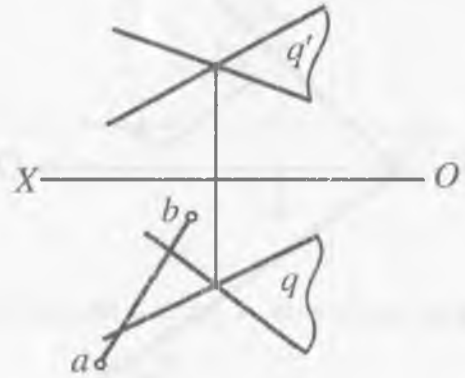


Task 38. Through A plane belonging to R, to the horizontal plane.

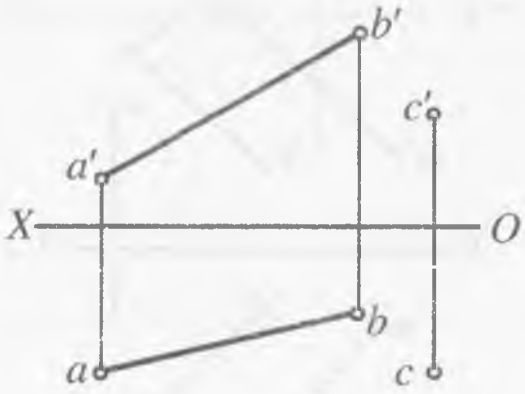


Task for self-education

Task 39. Determine the front view of the line AB, owned the plane Q, if you know its horizontal projection.

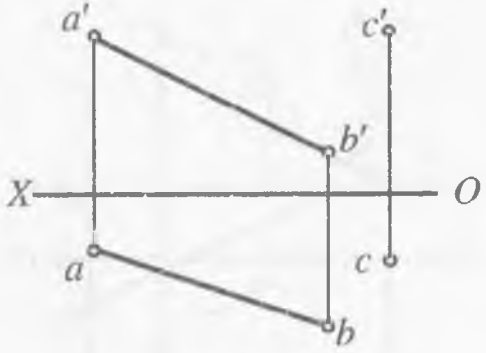


Task 40. Cross the line, given the segment AB, direct EC, passing through point C and parallel to the horizontal plane of projection.

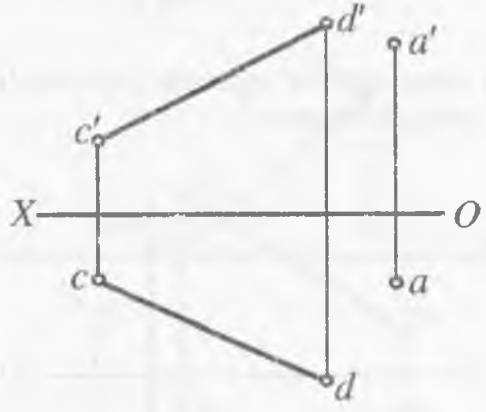


Task for self-education

Task 41. Through C draw a straight line that intersects the (AB) and the x-axis.

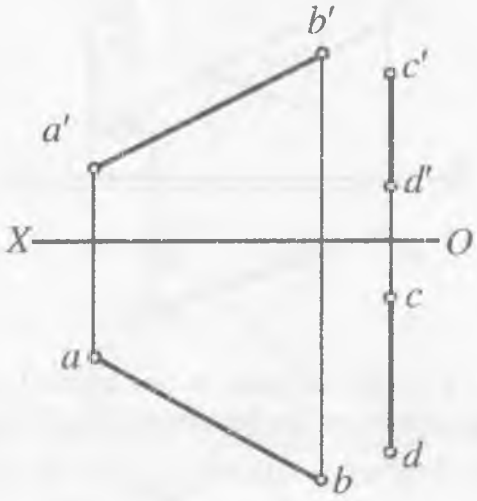


Task 42. Through the point A line parallel to the frontal plane of the projection of the line intersecting the line (CD).

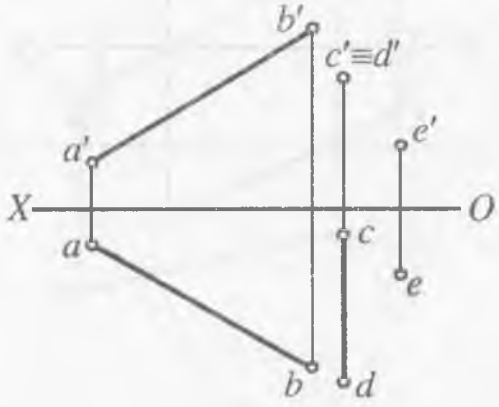


Task for self-education

Task 43. Direct defined segments [AB] and [CD] cross the line parallel to the horizontal plane of projection.

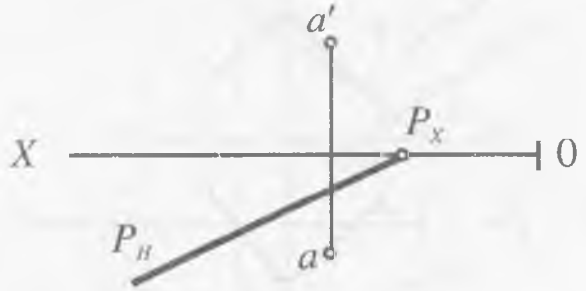


Task 44. Direct defined segments [AB] and [CD] to cross the line (EC) through the point E

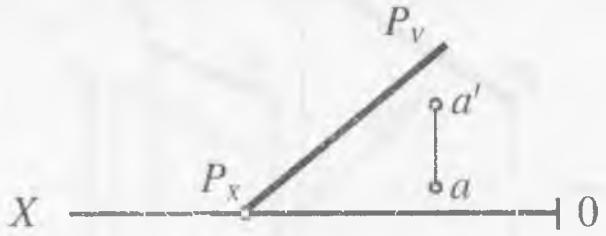


Task for self-education

Task 45. Build a front track of the plane P, if we know that A belongs to the plane.

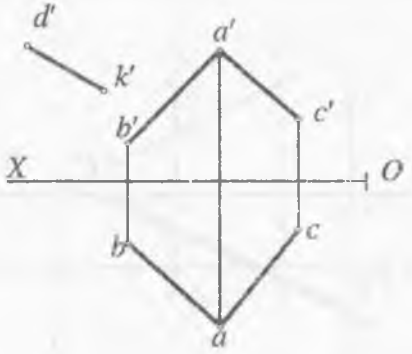


Task 46. Build a horizontal trace of the plane P, if we know that A belongs to the plane.

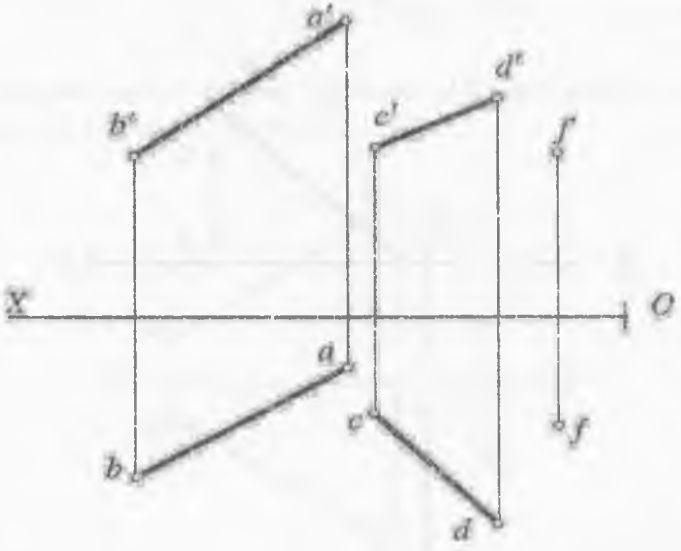


Task orf self-education

Task 47. Build a direct projection of the missing DK, belonging to a given plane ABC.

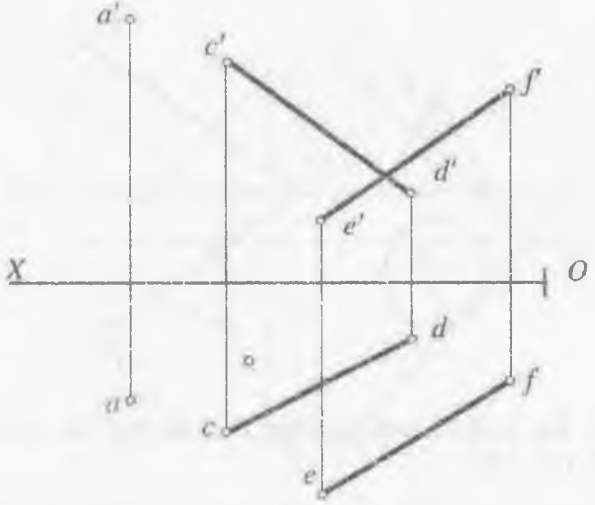


Task 48. Determine the point of intersection of the line CD with the plane defined by the line AB and the point of **Ъ.**

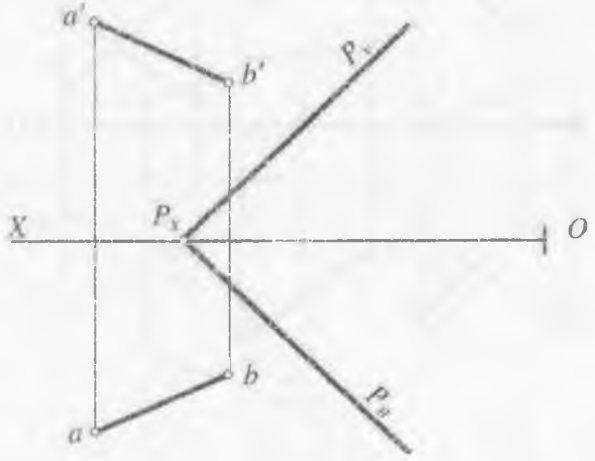


Task for self-education

Task 49. Determine the point of intersection of the line with the plane of the CD, given the direct EЪ i point A.

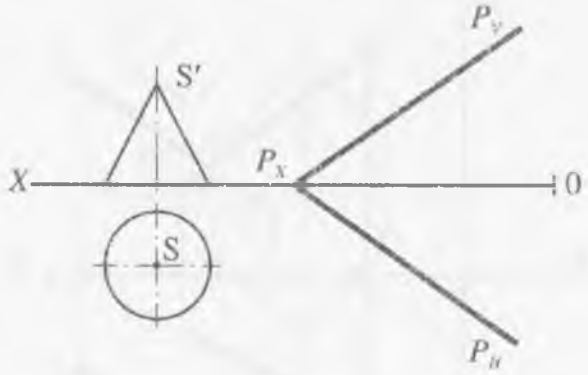


Task 50. Determine the point of intersection of the line AB and the plane P.

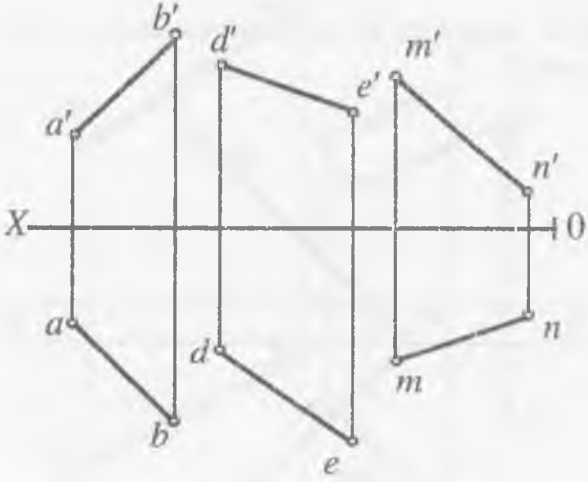


Task for self-education

Task 51. Carry straight on the surface of the cone parallel to the plane.

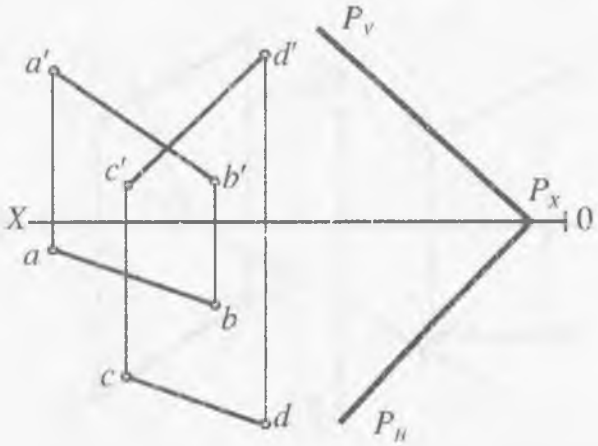


Task 52. Build a straight line intersecting the given skew lines AB, DE, MN.

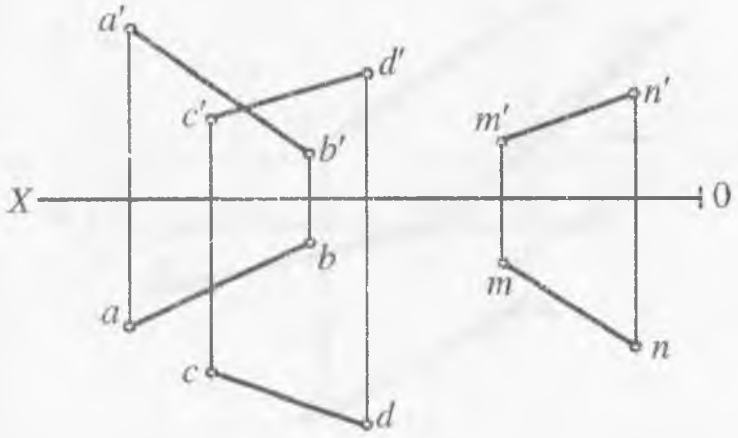


Task for self-education

Task 53. Draw a straight line perpendicular to the plane of the MN P and intersecting the given skew lines AB and CD.

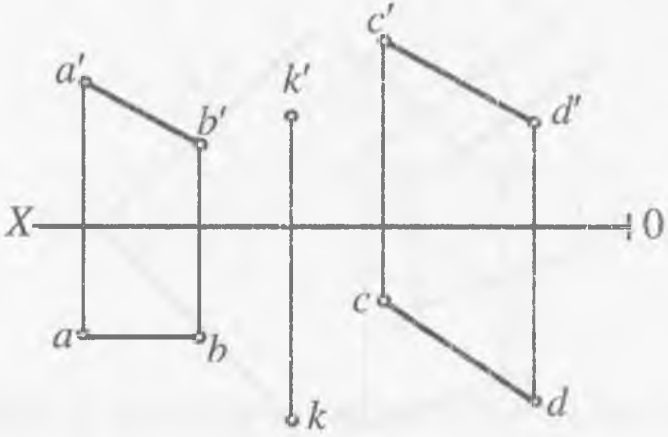


Task 54. Draw a straight line that intersects the skew lines AB and CD, parallel to the line MN.

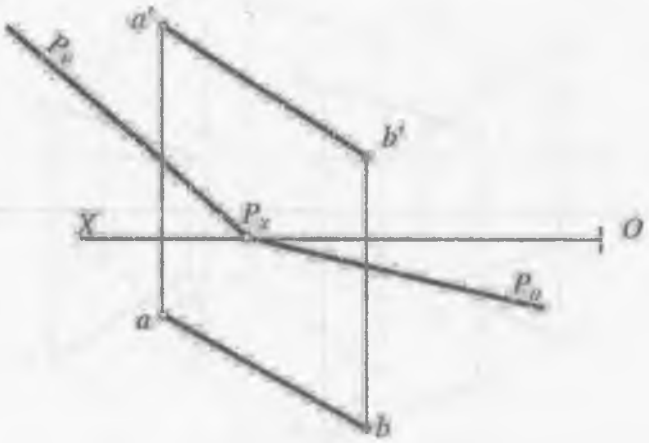


Task for self-education

Task 55. Through a point to draw a straight line perpendicular to the line CD and intersecting the line AB.

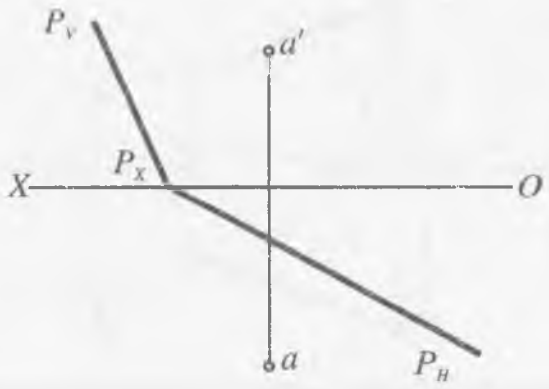


Task 56. Determine the point of intersection of the line AB and the plane P.

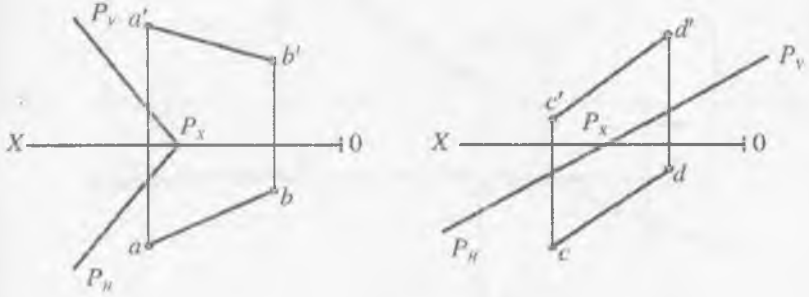


Task for self-education

Task 57. Through the point A to the plane Q, perpendicular to the plane defined by P.



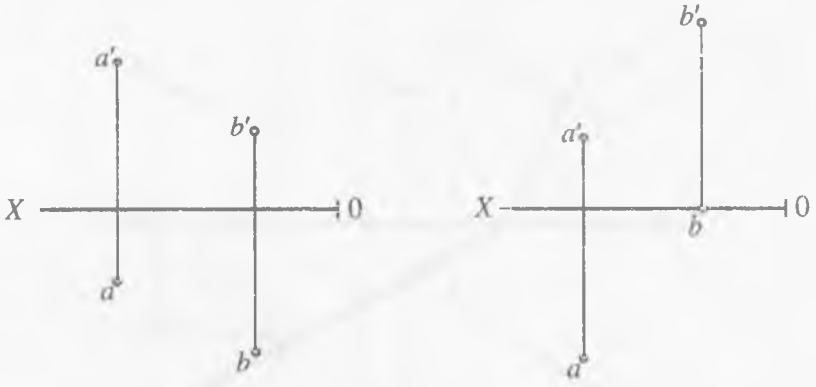
Task 58. Through the line AB to the plane Q, perpendicular to this plane P.



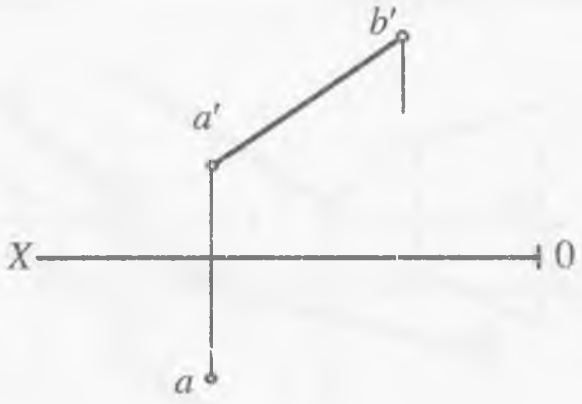
Task for self-education

IV. Metric tasks.

Task 59. Determine the distance between points A and B

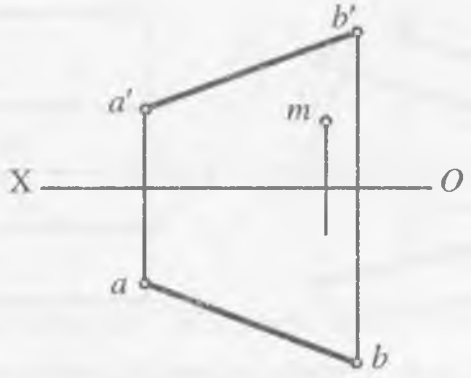


Task 60. Build a horizontal projection of the segment AB, if you know its length equal to 35 mm.

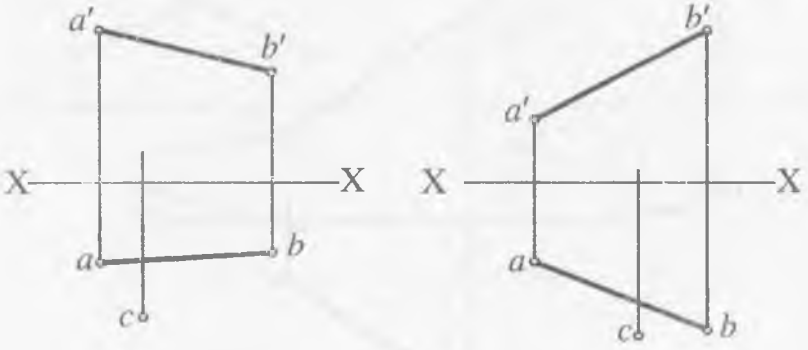


Tasks for self-education

Task 61. Find the horizontal projection of M equidistant from the ends of the segment AB.

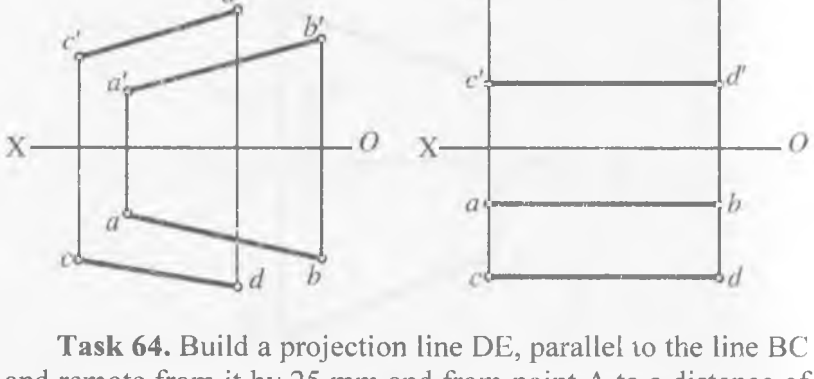


Task 62. Determine the front view of the point if its distance from the line AB is 20 mm.

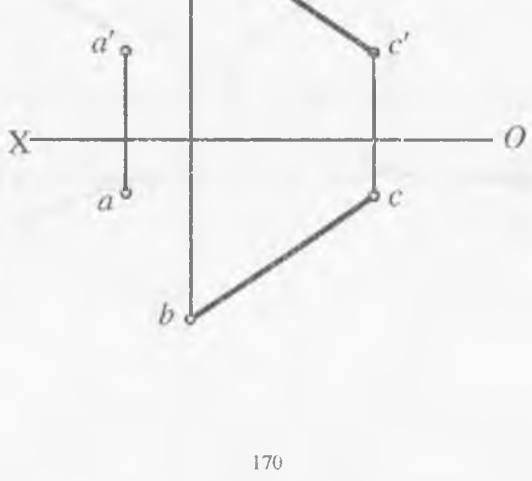


Task for self-education

Task 63. Determine the distance between the parallel lines AB and CD.

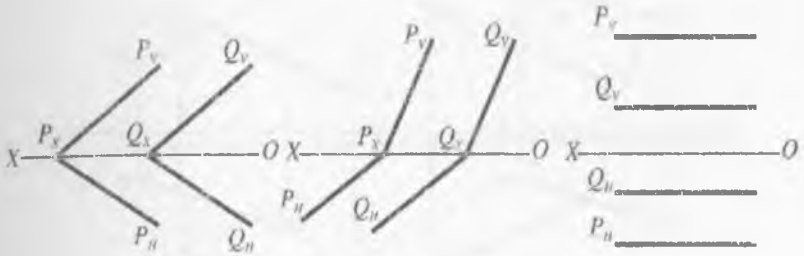


Task 64. Build a projection line DE, parallel to the line BC and remote from it by 25 mm and from point A to a distance of 20 mm.

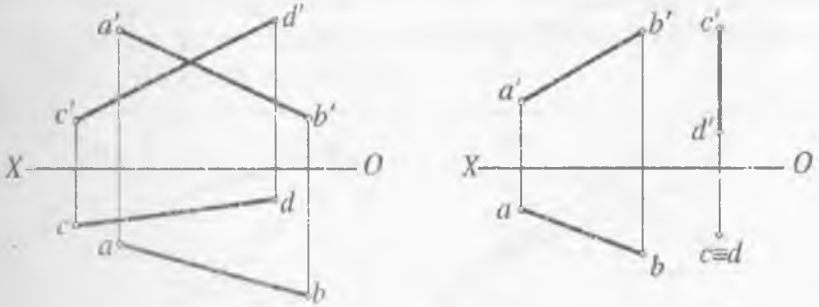


Task for self-education

Task 65. Determine the distance between the planes P and Q.

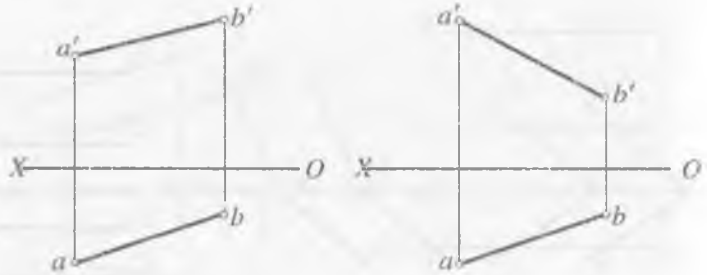


Task 66. Determine the distance between the skew lines AB and CD.

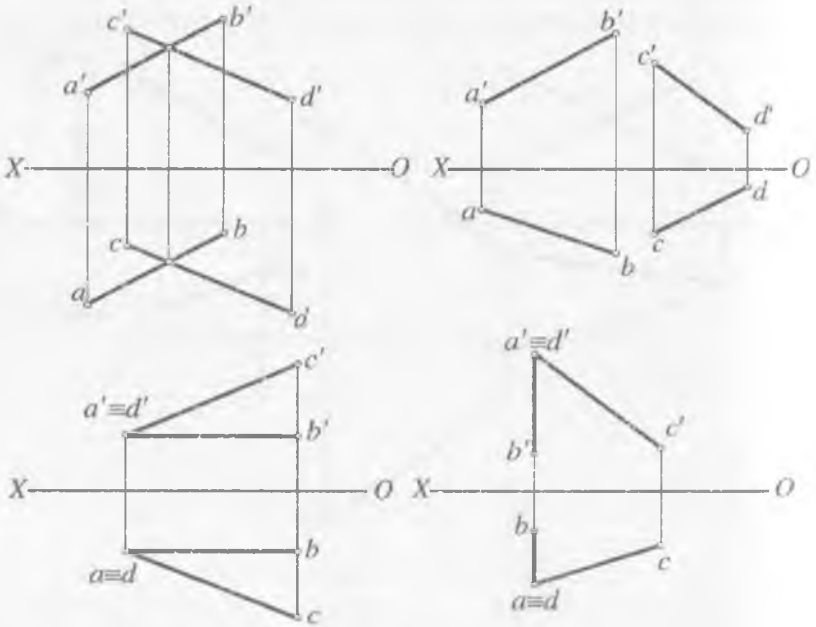


Task for self-education

Task 67. Determine the distance between the line AB and the axis X.

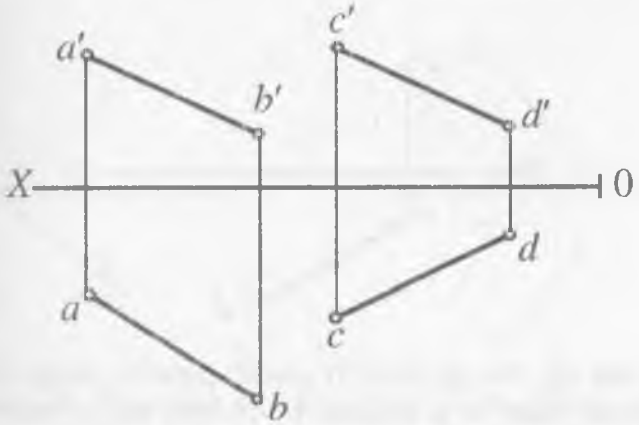


Task 68. Determine the angle between the intersecting lines AB and CD.

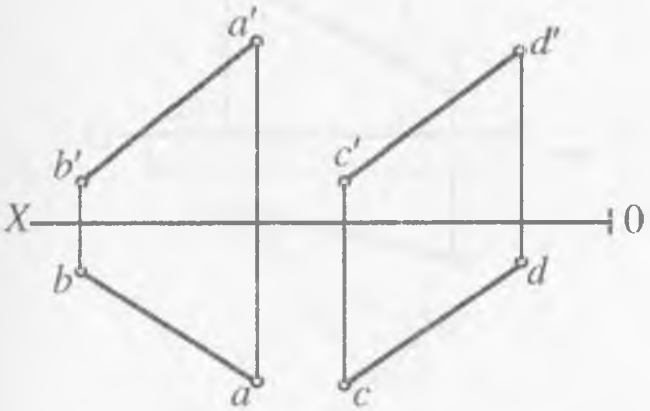


Task for self-education

Task 69. On the line AB to find the point of keeping up with CD at a distance of 40 mm.

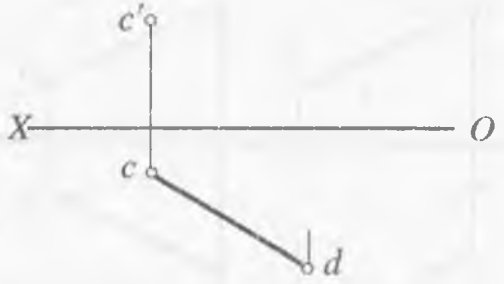


Task 70. Given skew lines AB and CD. Build a direct parallel to CD, and keeping up with her at a distance of 20 mm, as well as crossing the line AB.

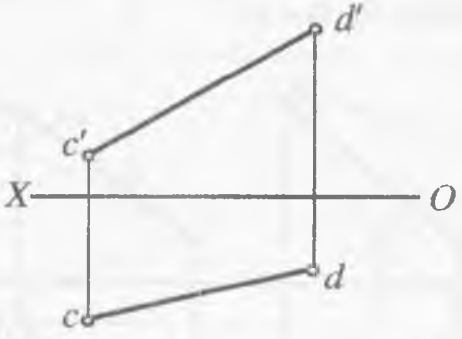


Task for self-education

Task 71. Build a front view of the segment CD, if you know its length equal to 30 mm.

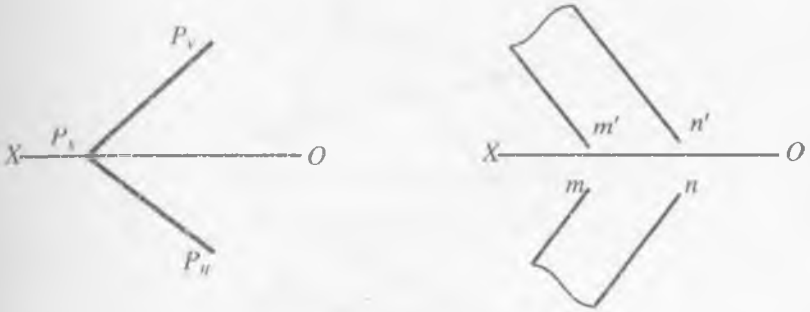


Task 72. On the line CD specify point A distant from the horizontal plane at a distance of 20 mm and a point in the distance to the front of the plane which is 15mm.

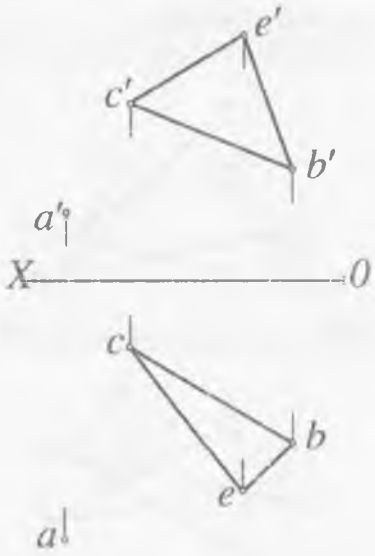


Task for self-education

Task 73. In plane P indicate a point A remote from the horizontal projection distance of 20 mm.

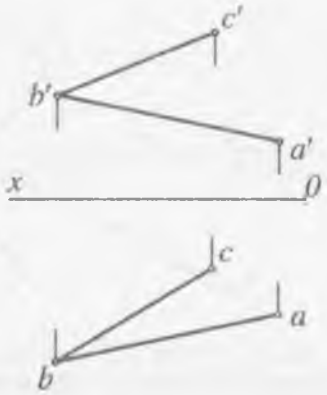


Task 74. Determine the value of the distance from point A to the plane of the ALL.

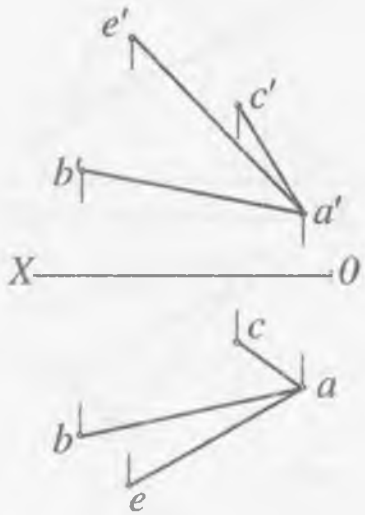


Task for self-education

Task 75. Construct a plane parallel to a distance of 40 mm from the ABC.

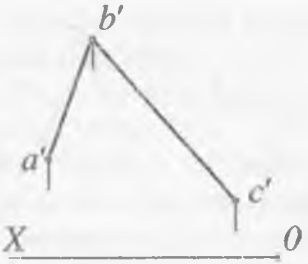


Task 76. On the line AE to find the point furthest from the plane ABC at a distance of 40 mm.

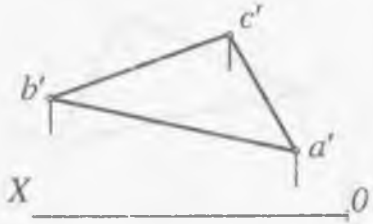


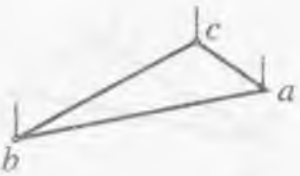
Task for self-education

Task 77. Construct a plane parallel to a distance of 40 mm from the ABC.



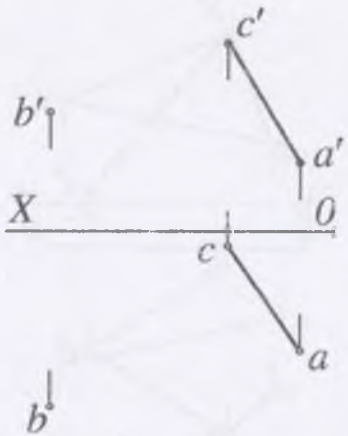
Task 78. Build a prism height of 40 mm, taking as its basis the triangle ABC.



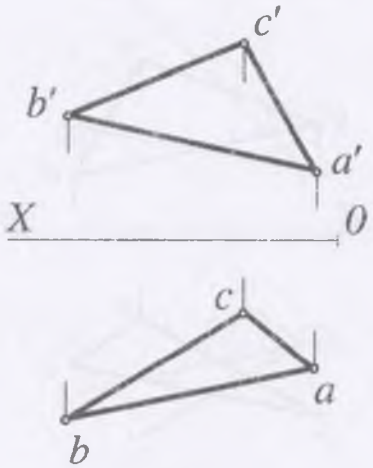


Task for self-education

Task 79. Determine the value of the distance from point B to the line CA.



Task 80. Determine the value of the height of the triangle ABC drawn across the top of the V.



Literature

1. State standards. ESKD. General rules for making drawings. Moscow: State Committee, 1991.

2. Frolov S.A. Descriptive Geometry. -M.: Mechanical Engineering, 1985.

3. Gordon V.O. etc. Problems in descriptive geometry. – M.: Mechanical Engineering, 1985.

4. Frolov S.A. Problems in descriptive geometry. – M.: Mechanical Engineering, 1986.

5. Azimov T.D. Synopsis of lectures on descriptive geometry. – T.: Tashkent State Technical University, 2001.

6. Azimov T.D., Faiziev T.R., D.U. Sabirova A manual for the practical lesson on descriptive geometry. ¬-T.: Tashkent State Technical University, 2003.

7. Azimov T.D. and the other the collection of questions on the 1st interim monitoring students' knowledge of descriptive geometry. – T.: Tashkent State Technical University, 2002.

8. Azimov T.D., D.U. Sabirova The collection of tests on descriptive geometry on "The Point." – T.: Tashkent State Technical University, 2007.

CONTENTS

V.N. Karimova

DESCRIPTIVE GEOMETRY AND ENGINEERING GRAPHICS

Editor:
A.Tilegenov

Technical editor:
D. Safayeva

Corrector:
S. Safayeva

Designer
G. Qulnazarova

License edition. №254
It was submitted to the press on 25.12.2019.
Format: 60x84 $^{1}/_{16}$ Offset printing. Headset "Times New Roman". Cond. pp 11.5. Circulation 200 pcs.
Order number 18.

The editors "NOSHIR," 100020, city Toshkent, str Langar-78.

Printed in the printing company "Shafoat Nur Fayz" city Tashkent. Uchtepa district, Makhorat 71., Phone: (+99899) 993-83-36

ISBN 978-9943-5483-7-4