

**O‘ZBEKISTON RESPUBLIKASI OLIY VA O‘RTA MAXSUS
TA‘LIM VAZIRLIGI**

**ISLOM KARIMOV NOMIDAGI
TOSHKENT DAVLAT TEXNIKA UNIVERSITETI**

CHIZMA GEOMETRIYA VA MUHANDISLIK GRAFIKASI

fanidan talabalarning uy-grafik ishlarini bajarish yuzasidan

uslubiy ko‘rsatmalar

I-qism

Toshkent – 2019

UDK.37.002.514 18.

Tuzuvchilar: Yakubova M.M., Mirzaraimova V.T., Samatova K.M.

“Chizma geometriya va muhandislik grafikasi” fanidan talabalarning uy-grafik ishlarini bajarish yuzasidan uslubiy ko’rsatmalar. I-qism. -T: ToshDTU, 2019. -24 b. ‘

“Chizma geometriya va muhandislik grafikasi” fanidan talabalarning uy-grafik ishlarini bajarish yuzasidan uslubiy ko’rsatmalar O‘zbekiston Respublikasi Oliy va o‘rta maxsus ta‘lim vazirligining texnika yo‘nalishlari bo‘yicha professional oliy ta‘lim Davlat standarti asosida bakalavrlar tayyorlash uchun mo‘ljallangan. Ushbu ko’rsatma "Chizma geometriya va muhandislik grafikasi" fanining namunaviy dasturlari asosida yaratildi.

Ushbu uslubiy ko’rsatma oliy texnika o‘quv yurtlaridagi barcha ta‘lim yo‘nalishlari 1-kurs talabalariga mo‘ljallangan. Unda chizma geometriya bo‘yicha grafikaviy uy ishlarini bajarish yuzasidan uslubiy ko’rsatmalar va ayrim nazariy ma‘lumotlar keltirilgan.

Islom Karimov nomidagi Toshkent davlat texnika universiteti ilmiy - uslubiy kengashining qaroriga muvofiq nashrga tayyorlandi.

Taqrizchilar: Kuchkarova D.F.- TIQXMMI “Chizma geometriya va muhandislik grafikasi” kafedrası professori, t.f.d.

Azimov T.D. - ToshDTU “Chizma geometriya va kompyuter grafikasi” kafedrası professori

KIRISH

Ushbu uslubiy ko'rsatma kunduzgi bo'limda bilim olayotgan barcha ta'lim yo'nalishlaridagi talabalar uchun mo'ljallangan bo'lib, unda chizma geometriya fani bo'yicha talabalarning mustaqil bajaradigan uy grafik ishlarini chizishga oid nazariy va amaliy uslubiy ko'rsatmalar bayon qilingan.

Chizma geometriya bo'lajak muhandisning konstruktiv-geometrik ijodiy fikrlashini shakllantiruvchi barcha oliy texnika o'quv yurtlarida o'qitiladigan fandır. Chizma geometriya chizmalarini bajarish va o'qish, kompyuter grafika va boshqa amaliy mexanika, mashina detallari, mashina mexanizmlari nazariyasi fanlarni muvaffaqiyatli o'zlashtirish uchun nazariy asos hisoblanadi. Chizma geometriyani o'rganishdan maqsad talabalarda fazoviy tasavvurni, konstruktiv-geometrik tafakkurni rivojlantirish va mavjud dunyo obyektlari bo'lgan fazoviy shakllarni tahlil qilish, amaliyotga tatbiq qilishdan iborat. Kursning vazifasi geometrik obrazlar - nuqta, to'g'ri chiziqlar, tekisliklar, sirlarni tasvirlash nazariyasi asoslarini o'rganish, geometrik jismlarning o'zaro joylashuviga (vaziyatiga oid) asoslangan masalalarni grafik usulda yechish va geometrik obrazlarning haqiqiy kattaliklarini aniqlash (o'lchovli masalani yechish) dan iborat. Shu maqsadda talabalarning uy-grafik vazifalarini animatsiyalashtirilgan variantlarini yaratish bo'yicha ish olib borilmoqda.

Uslubiy ko'rsatmada barcha talabalarning bajarishi zarur bo'lgan chizmalar to'plami sarvarag'ining namunasi keltirilgan. Shuningdek, uchburchak tekisligining izlarini chizish, nuqtadan tekislikkacha bo'lgan masofa haqiqiy uzunligini aniqlash, nuqtadan to'g'ri chiziqqa perpendikulyar tekislik o'tkazish va berilgan uchburchak tekislikka 20 mm masofada parallel bo'lgan tekislik o'tkazish kabi grafikaviy mustaqil uy ishlarini bajarish namunalari berilgan. Uy-grafik ishlarining 30 ta variantlari jadvali ko'rsatilgan. Talaba variantini amaliy dars olib boruvchi o'qituvchi guruh jurnali ro'yxati asosida belgilab beradi.

CHIZMALARNI BAJARISH YUZASIDAN TALABLAR

1. "Chizma geometriya" va "muhandislik grafikasi" kurslari bo'yicha bajariladigan individual uy vazifalarining barcha chizmalari, DS "Единая система конструкторской документации" (ЕСКД) qoidolari asosida bajarilishi kerak.
2. Chizmalar (epyurlar) **A3(297x420)** formatli chizma qog'ozida bajariladi.
3. Chizmaning asosiy yozuvi DS2.104-68 (I-forma) bo'yicha bajariladi.
4. Chizma maydonining o'ng tomonidagi yuqori burchagida, ramka Chiziqlariga yaqin joyga koordinatalar jadvali joylashtiriladi (5-nomerli standart shriftlar yordamida yoziladi).

	A	B	C	S
X				
Y				
Z				

Diagram showing a 4x5 grid with dimensions 10 and 7.5 indicated. The grid is labeled with X, Y, Z on the left and A, B, C, S on the top. A dimension of 10 is shown for the first column, and 7.5 is shown for the first row.

5. Chizmaning pastki chap tomonidagi masalani sharti 5-raqamli (kichik harflar) shriftlar bilan yoziladi.
6. Chiziqlarning quyidagi turlari va qalinliklari tavsiya etiladi:
 - a) asosiy tutash chiziq - ko'rinadigan kontur chiziqlari, ramka chiziqlari, asosiy yozuv, koordinatalar jadvali, berilgan elementlar, qalinligi **0,8...1,0 mm**;
 - b) ingichka tutash chiziq - proyeksion bog'lanish va yordamchi yasash chiziqlari qalinligi **0,2...0,3 mm**;
 - d) ingichka tutash chiziq - proyeksiya o'qlari, qalinligi **0,3...0,5 mm**
7. Izlanayotgan elementlar (masalani javobi) qizil rangda ajratib ko'rsatilishi kerak.
8. Nuqtalarni (berilgan, yordamchi va izlanayotganlari) krontsirkul yordamida diametri **1,0...1,5 mm** bo'lgan aylanalar shaklida bajariladi.
9. O'qituvchi tomonidan tekshirilgan va qo'l qo'yilgan barcha chizmalar studentga qaytarib beriladi. Har bir student bu chizmalarni albom ko'rinishida broshyurovka qilib, imtihonga kirish vaqtida uni o'qituvchiga topshiradi.
10. Chizmalar albomining muqovasi "titul varag'i" bo'lib, uni quyida keltirilgan namunadek bajarish kerak.

TDTU

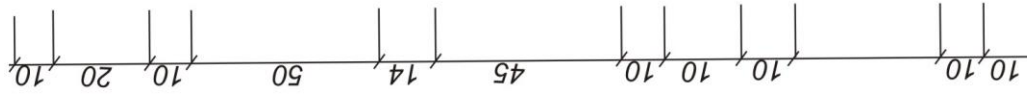
Chizma geometriya va kompyuter grafikasi kafedrası

CHIZMALAR TOPLAMI

Shifr: 12-18 M

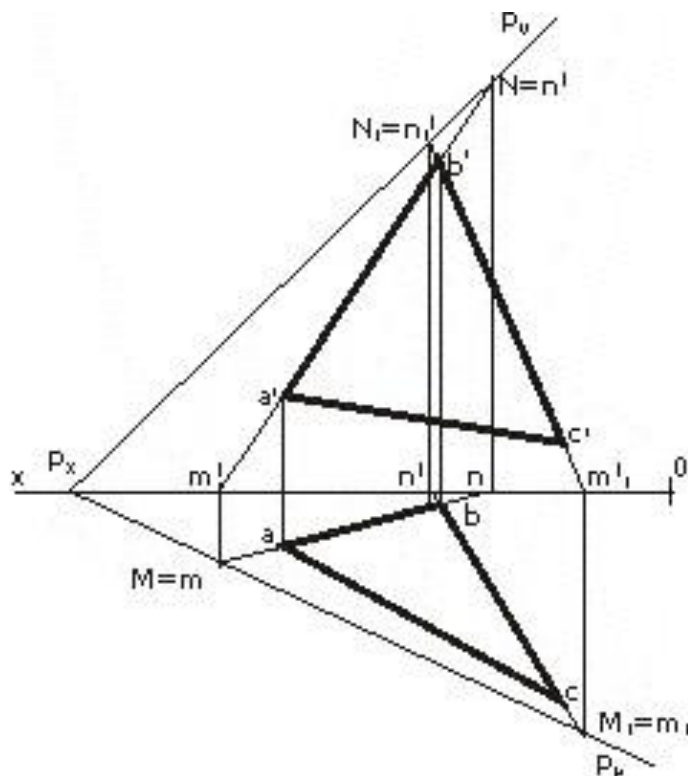
Bajardi: Botirov A.

2018-2019 oquv yili



I - EPYUR

I-masala. Uchburchak **ABC** orqali berilgan **P** tekislikning **P_H** va **P_V** izlari qurilsin (1-chizma).



1-chizma

MASALANI YECHISH ALGORITMI

1. **P_(ABC)** tekisligiga tegishli ikki to‘g‘ri chiziqning izlarini topamiz:

$$\mathbf{M} = (\mathbf{AB}) \cap \mathbf{H} \quad \mathbf{M} = (\mathbf{AB}) \cap \mathbf{V}$$

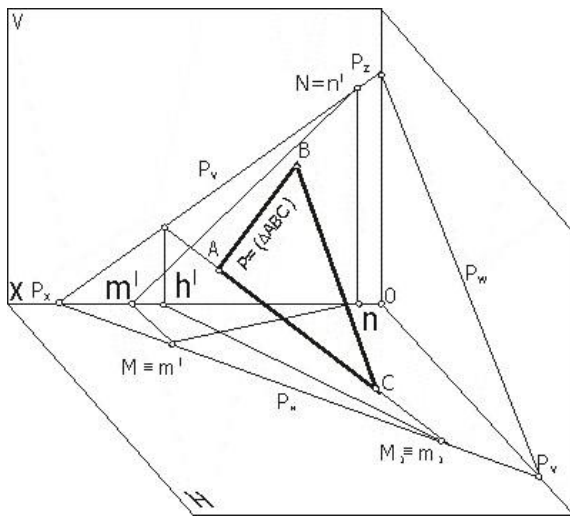
$$\mathbf{M} = (\mathbf{BC}) \cap \mathbf{H} \quad \mathbf{M} = (\mathbf{BC}) \cap \mathbf{V}$$

2. Topilgan izlarining bir nomlilarini birlashtiramiz, ya’ni

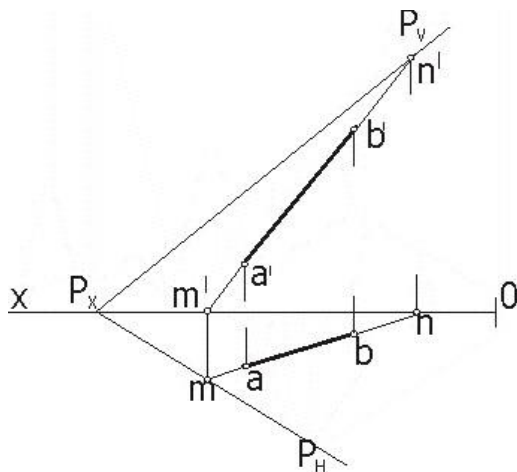
$$\mathbf{M} \cup \mathbf{M}_I = \mathbf{P}_H \quad \text{va} \quad \mathbf{N} \cup \mathbf{N}_I = \mathbf{P}_V$$

Eslatma: Tekislikning izlarini yasashda uning gorizontal va frontal chiziqlaridan ham foydalanish mumkin.

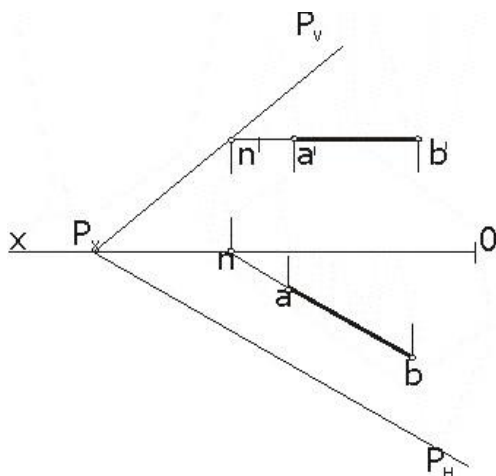
NAZARIY QISMI



2-chizma



3-chizma



4-chizma

1. Birorta **P** tekislikning proyeksiyalar tekisliklari bilan kesishuv chiziqlariga tekislikning **izlari** deyiladi (2-chizma).

$$P \cap H = P_H, P \cap V = P_V, P \cap W = P_W.$$

2. Agar tekislik proyeksiyalar o'qini kesib o'tsa, shu o'qda tekislik izlarining kesishuv nuqtasi hosil bo'ladi.

P tekislikni proyeksiyalar o'qi bilan kesishuv nuqtasiga tegishli izlarining uchrashuv nuqtasi deyiladi:

$$P \cap X = P_X, P \cap Y = P_Y, P \cap Z = P_Z.$$

3. Agar to'g'ri chiziq **(AB)** P tekislikda yotgan bo'lsa, bu to'g'ri chiziqning bir nomli izlari tekislikning bir nomli izlarida yotadi (3-chizma).

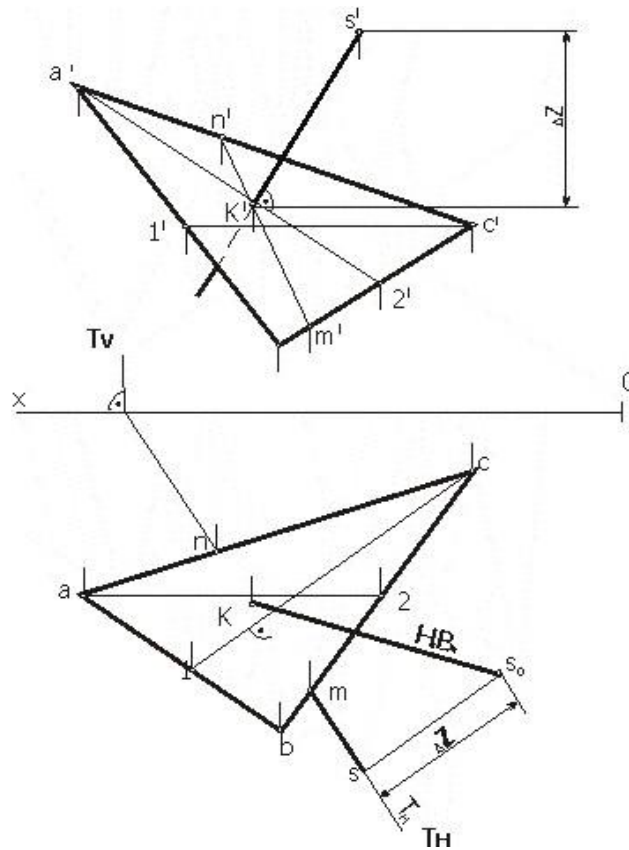
$$(AB) \subset P \Leftrightarrow N \subset P_V \wedge M \subset P_H$$

4. Agar to'g'ri chiziq **(AB)** P tekislikda yotgan va H tekislikka parallel bo'lsa, to'g'ri chiziqning gorizontaal proyeksiyasi tekislikning gorizontaal iziga parallel bo'ladi (4-chizma).

$$(AB) \subset P \wedge (AB) \parallel H \Rightarrow P_H \parallel (ab)$$

II- EPYUR

2-masala. S nuqtadan $P_{(\Delta ABC)}$ tekislikkacha bo'lgan masofa aniqlansin.
| $SP_{(\Delta ABC)}$ | (5-chizma)

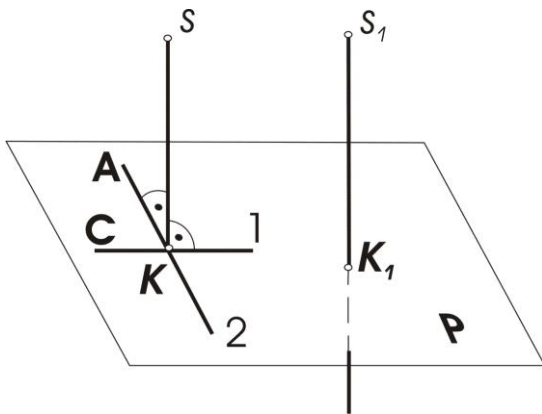


5-chizma

MASALANI YECHISH ALGORITMI

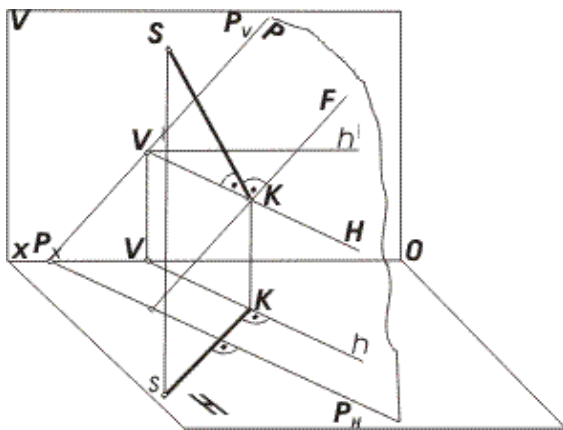
1. Perpendikulyarning yo'nalishini aniqlaymiz.
2. Perpendikulyarning asosini, ya'ni uning tekislik bilan kesishish nuqtasini topamiz.
3. Perpendikulyarning haqiqiy uzunligini aniqlaymiz.

NAZARIY QISMI



6-chizma

1. Nuqtadan tekislikkacha bo'lgan masofa nuqtadan tekislikka tushirilgan perpendikulyar uzunligi bilan o'lchanadi.
2. Agar to'g'ri chiziq tekislikdagi o'zaro kesishuvchi ikki to'g'ri chiziqqa perpendikulyar bo'lsa, bu to'g'ri chiziq tekislikka ham perpendikulyar bo'ladi (6-chizma).

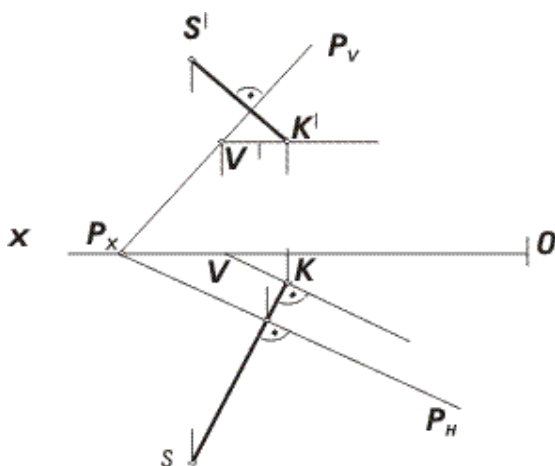


7-chizma

3. Kesishuvchi ikki to'g'ri chiziqlar sifatida tekislikning gorizonta (**H**) va fronta (**F**) chiziqlaridan foydalanamiz, chunki bu holda epyurda to'g'ri burchak o'zgarmasdan proyeksiyalanadi (7-chizma).

E P Y U R D A:

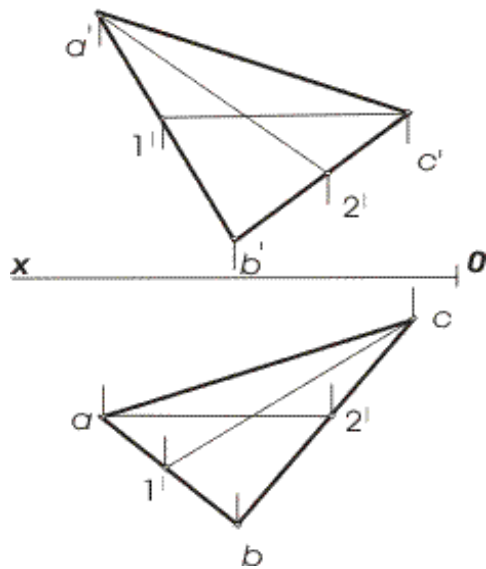
$$[SK] \perp P \Leftrightarrow [S'K'] \perp P_V \wedge [SK] \perp P_H \wedge [S''K''] \perp P_W$$



8-chizma

8-chizma

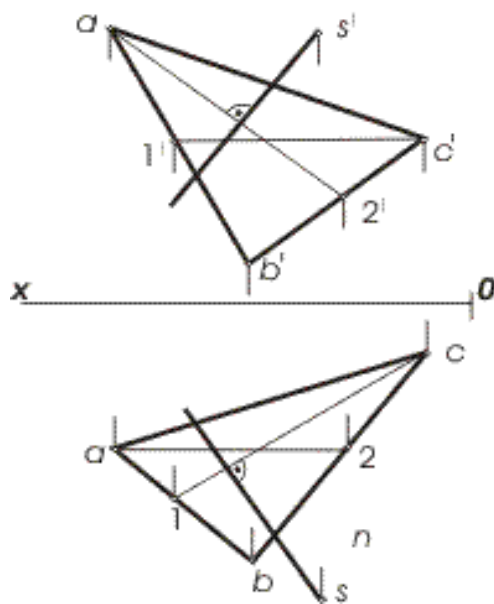
MASALANI YECHISH



9-chizma

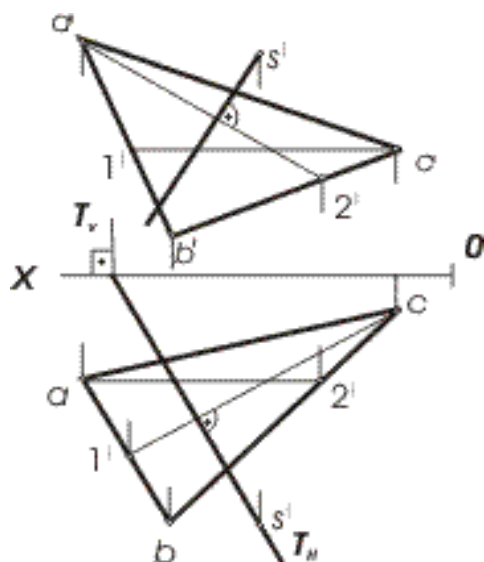
1. Perpendikulyarning yoʻnalishini aniqlaymiz:

a) $P_{(\Delta ABC)}$ tekislikning gorizontal (C1) va frontal (A2) chiziqlarini oʻtkazamiz (9-chizma).



10-chizma

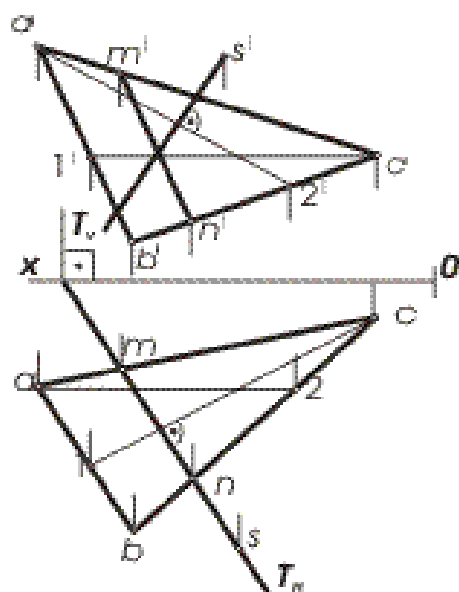
b) perpendikulyar chiziqning frontal proyeksiyasi frontal chiziqning frontal proyeksiyasiga ($a'2'$) perpendikulyar, gorizontal proyeksiyasi esa gorizontal chiziqning gorizontal proyeksiyasiga ($c1$) perpendikulyar boʻladi. (10-chizma)



11a-chizma

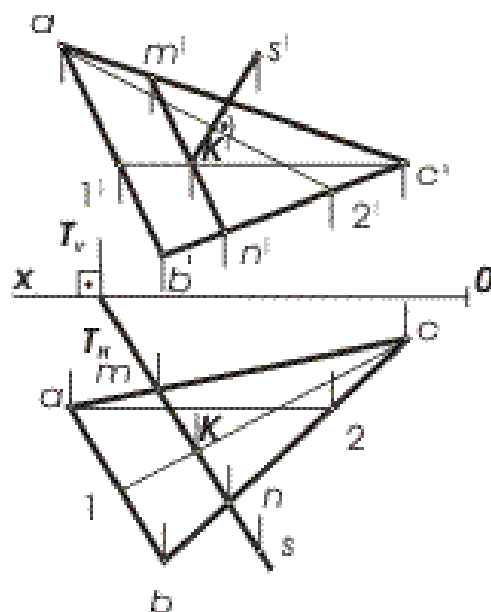
2. Perpendikulyarning asosini, ya'ni uning $P_{(\Delta ABC)}$ tekislik bilan kesishish nuqtasini topamiz:

a) perpendikulyardan yordamchi proyeksiyalovchi $T(T_H, T_V)$ tekislik o'tkazamiz (11a-chizma).



11b-chizma

b) $P_{(\Delta ABC)}$ va yordamchi T tekisliklarning kesishish chizig'ini ($MN - mn, m'n'$) aniqlaymiz; (11b-chizma)



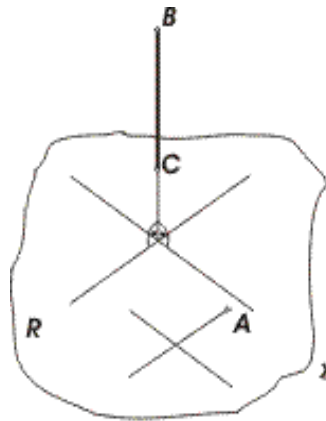
11d-chizma

d) perpendikulyar bilan MN to'g'ri chiziqning kesishish K nuqtasini aniqlaymiz: (11d-chizma)

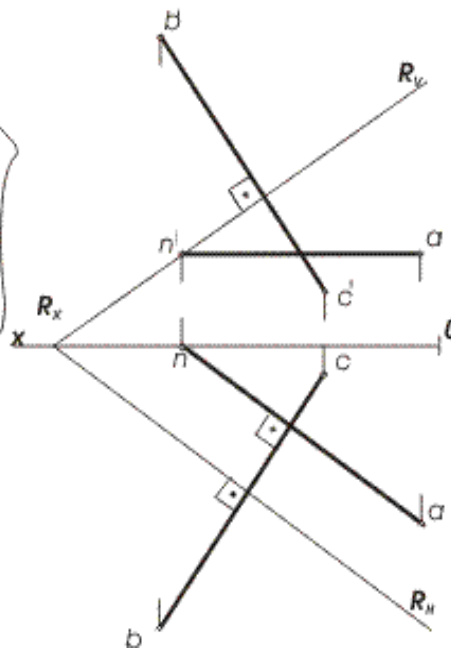
$$[SK] \cap (MN) = K$$

III- E P Y U R

3-masala. A uchidan o'tuvchi va BC tomoniga perpendikulyar bo'lgan R (R_H , R_V) tekislik o'tkazilsin (14-chizma).

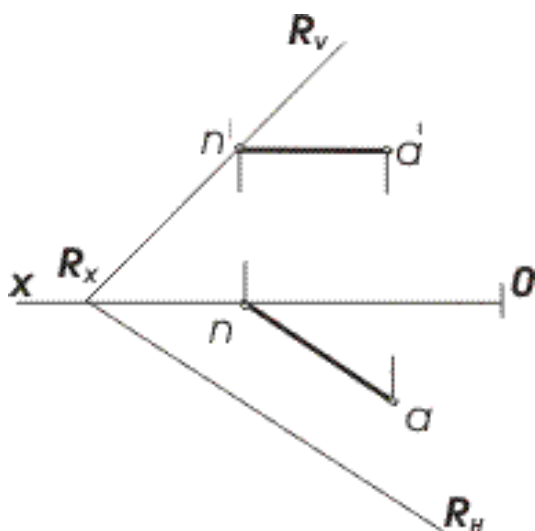


14a-chizma



14b-chizma

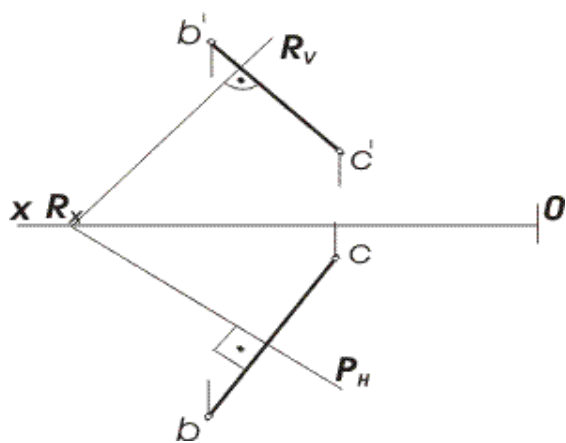
NAZARIY QISMI



15-chizma

1. Agar nuqta tekislikda yotuvchi birorta to'g'ri chiziqa tegishli bo'lsa, nuqta tekislikka ham tegishli bo'ladi.

Bunday to'g'ri chiziq sifatida tekislikning gorizontali yoki frontal chiziqlari olinadi (15-chizma).

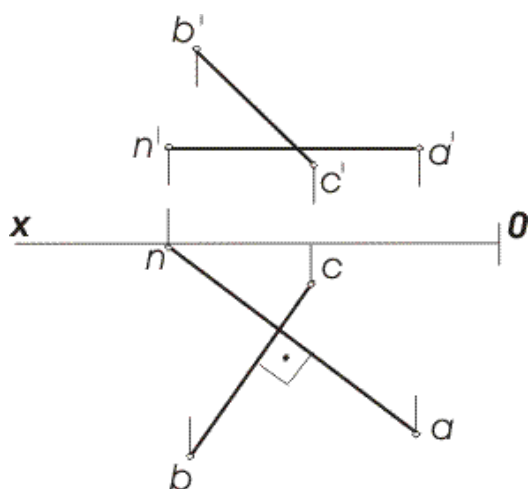


16-chizma

2. Agar to'g'ri chiziq tekislikda yotuvchi kesishuvchi ikki to'g'ri chiziqqa perpendikulyar bo'lsa, to'g'ri chiziq tekislikka ham perpendikulyar bo'ladi (16-chizma).

Tekislikning izlari shunday kesishuvchi ikki to'g'ri chiziq bo'ladi.

MASALANI YECHISH



17-chizma

1. A nuqta orqali BC ga perpendikulyar qilib gorizonta (yoki frontal) o'tkazib, uning $N(n', n)$ izini topamiz (17-chizma).

$$(AN) \perp (BC) \Leftrightarrow (an) \perp (bc) \wedge (a'n') \parallel [Ox]$$

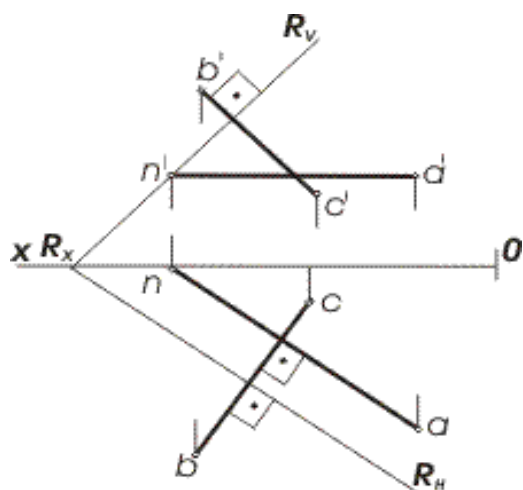
2. Topilgan N nuqtadan BC ga perpendikulyar R tekislikni o'tkazamiz. (18-chizma)

$$(\bullet) A \in R \wedge R \perp (BC)$$

E P Y U R D A:

$$n' \in R_v \perp (b'c') \wedge R_H \perp (bc)$$

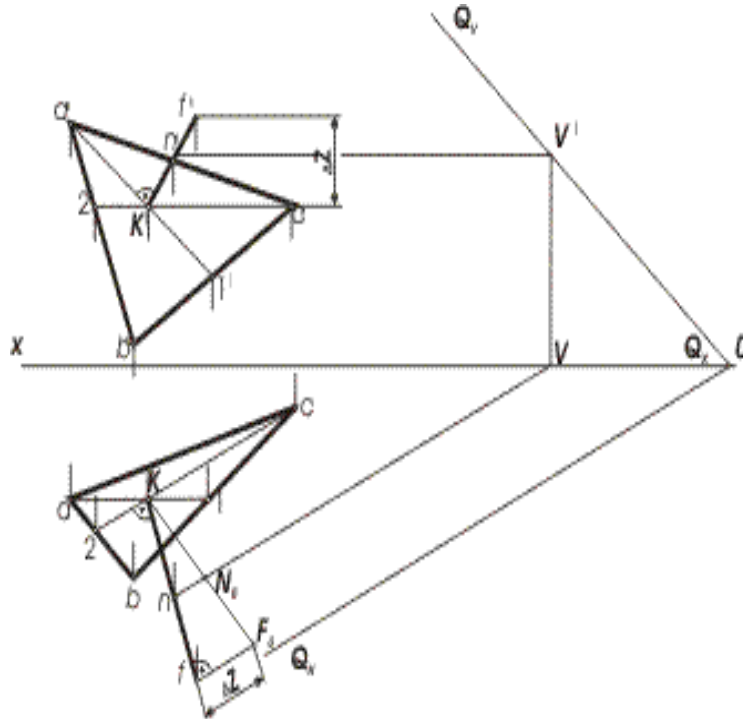
$$R_x = R \cap [Ox).$$



18-chizma

IV - E P Y U R

4-masala. Berilgan $P_{(\Delta ABC)}$ tekislikka parallel va undan **20 mm** masofada o'tgan $Q(Q_H, Q_V)$ tekislik yasalsin (19-chizma).



19-chizma

MASALANI YECHISH ALGORITMI

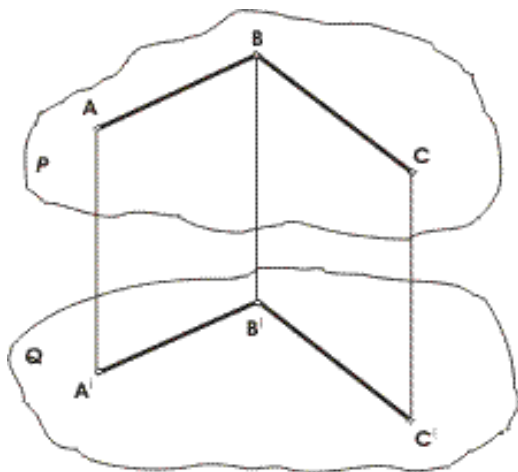
1. Berilgan $P_{(\Delta ABC)}$ yotuvchi ixtiyoriy nuqtadan perpendikulyar o'tkazamiz.
2. Perpendikulyarning asosidan **20 mm** masofani o'lchab, **N** nuqtani topamiz - **[KN] = 20 mm**.
3. **N** nuqta orqali $P_{(\Delta ABC)}$ tekislikka parallel $Q(Q_H, Q_V)$ tekislik o'tkazamiz.

Eslatma: berilgan masalani sharti bo'yicha ikkita tekislik o'tkazish mumkin.

NAZARIY QISMI

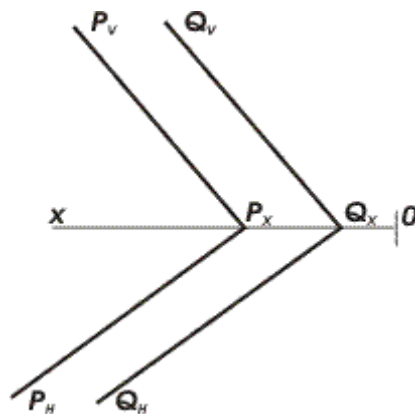
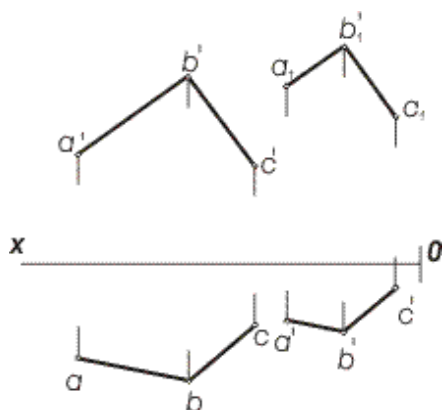
TEOREMA (ikki tekislikning parallellik alomati).

Agar bir tekislikning kesishuvchi ikki to'g'ri chizig'i ikkinchi tekislikning kesishuvchi ikki to'g'ri chizig'iga mos ravishda parallel bo'lsa, bu tekisliklar ham o'zaro parallel bo'ladi (20-chizma).



20-chizma

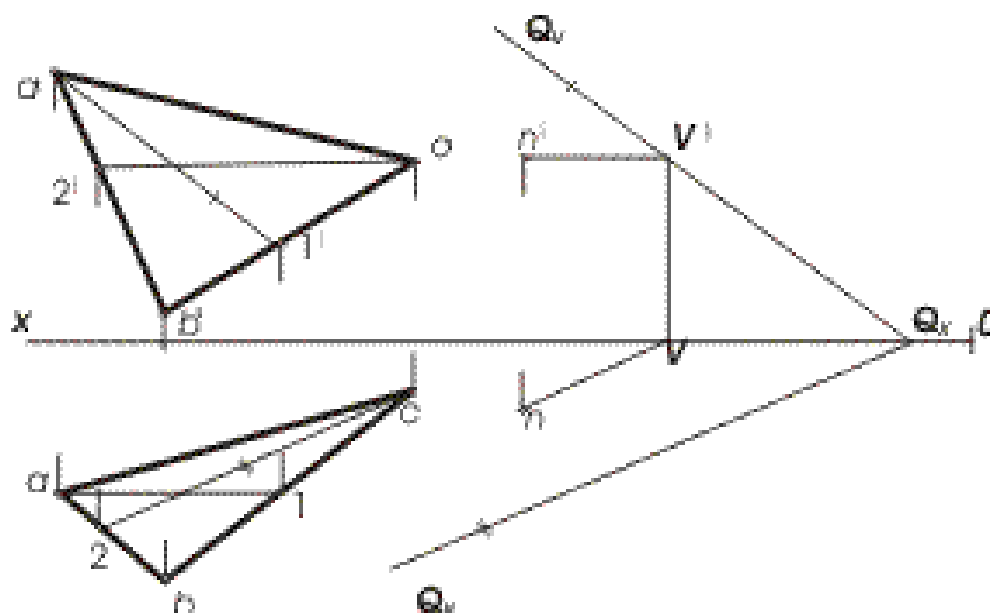
E P Y U R D A: (21-chizma)



21-chizma

$$(AB) \parallel (A_1 B_1) \wedge (BC) \parallel (B_1 C_1)$$

$$P \parallel Q \Leftrightarrow P_H \parallel Q_H \wedge P_V \parallel Q_V$$

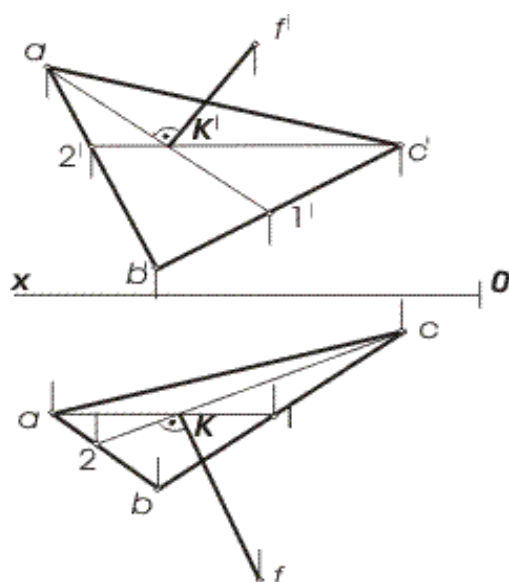


22-chizma

$$Q \parallel P_{(\Delta ABC)} \Rightarrow Q_V \parallel (A2) \wedge Q_H \parallel (C1)$$

E p y u r d a: $Q_V \parallel (a'2') \wedge Q_H \parallel (c1)$

MASALANI YECHISH



23-chizma

1. $P_{(\Delta ABC)}$ tekisligida ixtiyoriy $K(k, k')$ nuqta olamiz. (qulaylik uchun $P_{(\Delta ABC)}$ tekislikning gorizontal va frontal chiziqlarining kesishish nuqtasi K olinadi) (23-chizma).

2. Olingan K nuqtadan $P_{(\Delta ABC)}$ tekislikka perpendikulyar o'tkazamiz.

3. Perpendikulyarni ixtiyoriy F nuqta bilan chegaralaymiz.

5. Topilgan N nuqta orqali berilgan $P_{(\Delta ABC)}$ tekislikka parallel $Q(Q_H, Q_V)$ tekislikni o'tkazamiz (25-chizma).

18

1-jadval

Nuqtalar	Koordinatalar	V A R I A N T L A R									
		1	2	3	4	5	6	7	8	9	10
A	X	110	105	110	10	115	90	110	100	100	115
	Y	85	90	10	100	95	90	90	5	25	30
	Z	50	55	65	30	85	80	90	35	15	10
B	X	25	15	85	40	95	65	95	10	65	80
	Y	45	50	80	40	25	10	0	30	85	90
	Z	5	15	5	100	5	10	20	95	90	95
C	X	90	85	30	115	10	10	10	30	20	10
	Y	5	15	40	55	5	20	65	100	10	10
	Z	105	95	90	5	50	65	45	5	55	60
D	X	130	105	130	25	40	110	55	120	120	120
	Y	50	30	30	50	95	30	5	95	50	15
	Z	55	45	60	15	5	35	110	10	60	70
E	X	60	50	10	65	10	35	115	10	10	20
	Y	90	100	90	5	35	70	50	65	70	35
	Z	10	5	10	75	65	100	80	35	105	90
F	X	10	10	60	100	115	15	25	60	40	60
	Y	10	5	5	100	15	15	85	5	5	85
	Z	90	80	100	40	35	20	0	70	10	15
S	X	100	30	45	25	60	35	70	80	45	40
	Y	25	90	10	30	85	65	90	70	75	85
	Z	20	100	25	10	10	10	10	70	15	25

Nuqtalar	Koordinatalar	V A R I A N T L A R									
		11	12	13	14	15	16	17	18	19	20
A	X	80	110	110	15	115	30	10	115	10	30
	Y	5	40	60	30	65	80	85	30	55	65
	Z	85	90	10	10	90	90	95	100	90	10
B	X	10	85	25	50	75	55	30	85	100	55
	Y	85	100	110	90	5	10	5	100	15	5
	Z	40	20	50	95	5	10	25	40	50	80
C	X	125	30	90	120	10	110	115	10	30	110
	Y	60	15	5	10	90	65	50	5	95	90
	Z	5	60	90	50	40	30	5	55	15	40
D	X	130	130	130	10	120	10	85	100	10	10
	Y	25	45	55	15	80	35	5	15	45	60
	Z	20	70	45	70	30	30	95	50	30	30
E	X	20	10	60	110	15	85	115	80	65	130
	Y	35	95	100	35	65	100	65	75	5	10
	Z	90	10	5	90	10	70	35	5	100	90
F	X	80	60	10	70	55	105	10	25	105	80
	Y	105	5	20	85	10	20	35	40	80	100
	Z	5	95	85	15	85	15	15	100	5	5
S	X	40	110	45	100	30	85	65	100	85	95
	Y	20	10	35	85	25	15	10	10	100	25
	Z	10	20	20	15	80	65	85	30	90	10

Nuqtalar	Koordinatalar	V A R I A N T L A R									
		21	22	23	24	25	26	27	28	29	30
A	X	30	15	30	30	115	60	30	15	15	30
	Y	50	90	90	10	10	85	35	95	10	15
	Z	85	65	40	60	30	5	5	95	30	25
B	X	115	55	55	115	80	130	120	30	50	65
	Y	5	5	20	50	95	40	95	25	95	90
	Z	45	5	100	110	90	85	30	5	90	85
C	X	50	120	110	50	10	15	100	115	120	110
	Y	105	40	60	90	50	5	5	50	60	55
	Z	5	90	15	5	10	60	100	70	10	10
D	X	10	10	10	10	120	10	10	70	10	10
	Y	55	30	70	45	70	20	10	115	70	60
	Z	50	80	45	55	15	25	95	10	15	50
E	X	80	115	30	80	20	120	120	10	110	120
	Y	10	10	10	5	90	90	35	85	90	105
	Z	90	65	95	10	35	35	65	55	35	70
F	X	130	75	80	130	60	90	70	100	70	90
	Y	90	85	95	85	15	5	70	5	15	10
	Z	10	10	5	20	85	105	5	90	85	5
S	X	40	100	30	95	30	100	50	65	90	85
	Y	10	80	20	20	15	10	70	15	25	15
	Z	25	25	10	35	85	20	70	95	85	75

Adabiyotlar

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Tuzuvchilar: Yakubova M.M., Mirzaraimova V.T., Samatova K.M.

“Chizma geometriya va muhandislik grafikasi” fanidan talabalarning uy-grafik ishlarini bajarish yuzasidan uslubiy ko‘rsatmalar. I-qism.

Muharrir: Miryusupova Z.M.