O`ZBEKISTON RESPUBLIKASI OLIY VA O`RTA MAXSUS TA`LIM VAZIRLIGI.

«Geodeziya, kartografiya va kadastr» kafedrasi.

«Geodeziya» fanidan “Geodeziya, kartografiya va kadastr” yo’nalishining 2 – kurs talabalari uchun "Poligonometriya yo’lini tenglashtirish va aniqligini baholash" mavzusidagi kurs ishini bajarishga doir

USLUBIY KO’RSATMALAR.

QARSHI – 2015.

Ushbu Uslubiy ko’rsatmalar «Geodeziya, kartografiya va kadastr» кafedrasi (Bayon №___ «___»_____201___ y) da muhokama etilgan va Muhandis texnika fakulteti Uslubiy komissiyasiga tavsiya etilgan.

Muhandis texnika fakulteti uslubiy komissiyasi (Bayon №___ «___»_____201___ y) da ko’rib chiqilgan va QMII Ilmiy – uslubiy kengashiga tavsiya etilgan.

Ushbu uslubiy ko’rsatma Qarshi muhandislik iqtisodiyot instituti Ilmiy – uslubiy kengashining “____” “_____” 201__ yilda bo’lib o’tgan №___- sonli majlisida ko’rib chiqildi va chop etishga tavsiya etildi.

Tuzuvchi: QarMII, “Geodeziya, kartografiya va kadastr” kafedrasi katta o’qituvchisi U. Tojiyev.

Taqrizchilar: 1.Qashqadaryo viloyati Yer tuzish va kuchmas mulk kadastri davlat korxonasi bosh muhandisi I. Raxmonov.

2.QarMII, “Geodeziya, kartografiya va kadastr” kafedrasi katta o’qituvchisi K. N. Xo’jakeldiyev.

Mazkur Uslubiy ko’rsatmalar 5311500 – “Geodeziya, kartografiya va kadastr” ta’limi yo’nalishining 2–kurs talabalari uchun «Geodeziya» fanidan "Poligonometriya yo’lini tenglashtirish va aniqligini baholash" mavzusidagi kurs ishini bajarish bo’yicha ishlab chiqilgan.

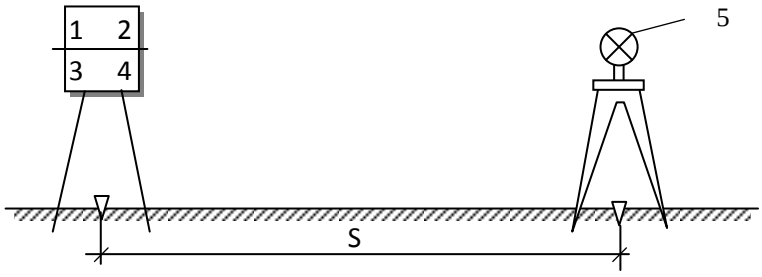
Poligonometriya to’rini tenglashtirish va aniqligini baholash.
Poligonometriya xillari.

Poligonometriya yo’li joyda siniq chiziqlardan iborat bo’lib, tomon uzunliklari va o’ng yoki chap tomon gorizontal burchaklari o’lchanadi. Poligonometriya ko’rinishi bo’yicha 2 xil bo’lib, ochiq yoki yopiq poligonlardan tashkil topgan bo’ladi.

Poligonometriyada burchaklar optik va elektron teodolitlar bilan, masofalar esa har xil asbob uskunalar bilan o’lchanadi.

Poligonometriyada masofa o’lchash usullari.

Svetodal’nomer poligonometriya barcha cinfdagi geodezik to’rlarni barpo qilish va zichlashtirishda, maxsus geodezik to’rlarni barpo qilishda qo’llaniladi. Jumladan: Svetodal’nomer yordamida masofa o’lchash yorug’lik nuri tezligiga asoslangan bo’lib, boshlang’ich nuqtaga svetodal’nomer, oxirgi nuqtaga esa nur qaytargich o’rnatilib, nurning borib qaytishiga sarf bo’lgan vaqt o’lchanadi.



1 – shakl.

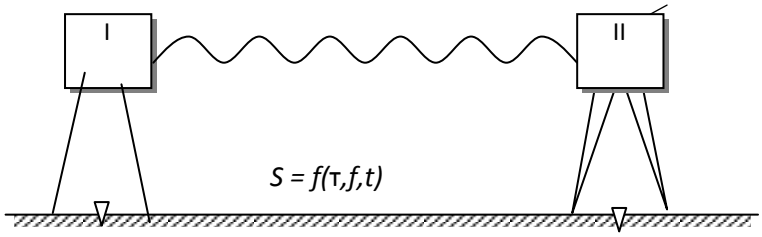
bu yerda:
1– vaqt o’lchagich,
2 – nur uzatgich, 3 – klavitura,
4 – nur qabul qilgich uskuna,
5 – nur qaytargich uskuna.

Masofa S quyidagi formula bilan aniqlanadi.

$$S = \frac{v \cdot t}{2}$$

Radiodal’nomer poligonometriya barcha sinfdagi geodezik to’rlarini barpo qilishda qo’llaniladi.

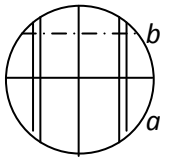
Radiodal’nomer yordamida masofa boshlang’ich va oxirgi nuqtalarga radio stansiya o’rnatilib, to’lqin uzunligi, amplituda va vaqtga asoslanib aniqlanadi.



2 – shakl.

Dal’nomer poligonometriya 2 – razryadli to’rlarini barpo qilishda qo’llaniladi, chunki optik dal’nomerlar yordamida masofa o’lchash aniqligi past darajada.

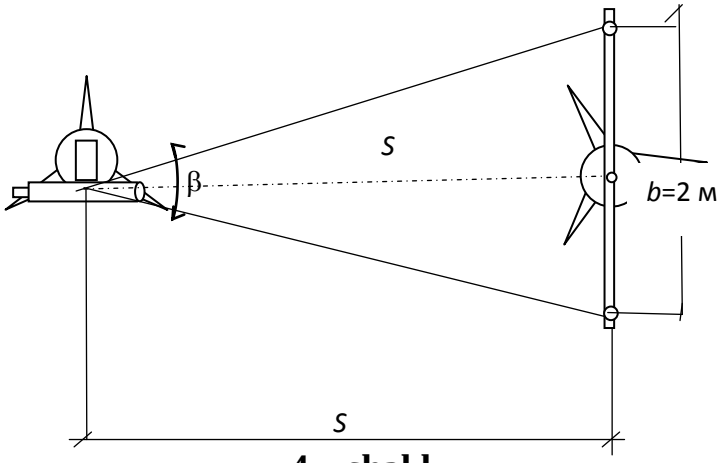
Optik dal’nomer yordamida masofa teodolit–taxeometr, dal’nomer, nivelir ko’rish trubasidagi iplar to’ri yordamida reykadan olingan sanoqlar farqi bo’yicha hisoblanadi **(3 – shakl).**



(3 – shakl). $S = \frac{a-b}{10}; (\text{m})$

Bevosita masofa o'lchashda poligonometriya tomoni uzunligi ruletka va maxsus tasmalar yordamida bevosita o'lchanadi.

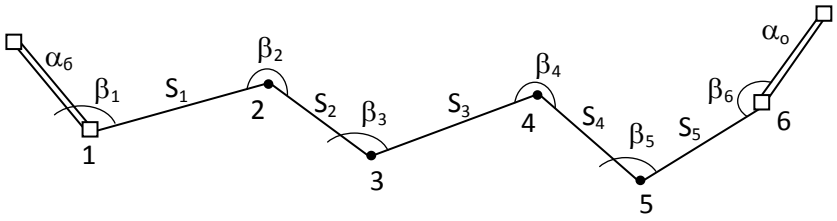
Qisqa bazisli paralaktik poligonometriya 1 va 2 razryad geodezik to'rlarini barpo qilishda qo'llaniladi. Qisqa bazisli paralaktik usulda masofani o'lchash uchun teodolit va uzunligi 2 metr bo'lgan metall jelzdan goydalaniladi.



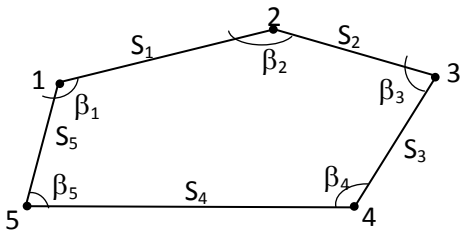
4 – shakl.

$$\frac{b/2}{S} = tg\beta \qquad \frac{b}{2} = Stg\beta \quad \text{bu yerdan } S = \frac{1}{tg\beta} = ctg\beta$$

Ochiq poligonli poligonometriya geodezik tayanch punktlariga tayanib, har xil ko'rinishdagi siniq ciziqlar to'plamidan iborat .



5 – shakl.



6 – shakl.

Yopiq poligonli poligonometriya bir nuqtadan boshlanib yana o'sha nuqtaga tutashadi. Ichki burchaklar yig'indisi ko'pburchaklar ichki burchaklarining yig'indisi sifatida quyidagi formula yordamida aniqlanadi (6 – shakl).

$$\Sigma\beta = 180^0 * (n - 1);$$

Poligonometriya to'rida qo'llaniladigan o'lchash asboblari.

III sinf poligonometriya to'rida burchak o'lchash aniqligi $1{,}5^{II}$ ni tashkil etadi. Demak burchaklarni o'lchash uchun juda aniq o'lchaydigan teodolitlardan foydalanish uchun ham masofa o'lchashda svetodal'nomer yoki radiodal'nomer asboblarini qo'llash maqsadga muvofiqdir.

III sinf poligonometriya to’ri bir yoki bir nechta yo’llar orqali II va I sinf poligonometriya to’riga tayanadi. III sinf poligonimetriya tomonining minimal uzunligi – 3 km, poligon perimetri uzunligi 60 km dan ortiq bo’lishi kerak.

1:25000 va 1:10000 masshtabli kartalarni yaratish uchun har 50–60 km^2 ga 1 punkt bo’lishi kerak. 1:5000 masshtabda 20–30 km^2 ga, 1:2000 masshtabda 5–15 km^2 ga 1 та poligonometriya punkti bo’lishi kerak.

Burchaklarni ulchash uchun optik teodolitlardan T1, ТБ1, T–05 (Rossiya) va elektron teodolit T2000, T3000 (Shvetsariya) larini qo’llash mumkin.

Masofa o’lchashda "Grant, CT3 (Rossiya), Reynjer VA, Reynjmaster III (AQSh) kabi svetodal’nomerlar, "Luch", MT-A1 (Vengriya), SIAL МД60С, SIAL МД 60S, Дistomat (Shvetsariya), tellurometr GMW20 (Angliya) lar qo’llaniladi.

Poligonometriya to’rini hisoblashda qo’llaniladigan formulalaridagi parametrlarning belgilanishi.

Poligonometriya to’rini hisoblash uchun quyidagi belgilanishlarni qabul qilamiz:

n – poligonometriya tomonlari soni;

S – poligonometriya tomonlari o’rtacha uzunligi;

$T_б$, T_0 – poligonometriya boshlang’ich va oxirgi tayanch punktlari;

$\alpha_б$, α_0 – poligonometriya boshlang’ich va oxirgi direksion burchaklari;

β – poligonometriya yo’lini chap tomon o’lchangan gorizontal burchaklari;

L – $T_б$ va T_0 tayanch punktlari orasidagi masofa;

m_β – o’lchangan gorizontal burchak o’rta kvadratik xatosi (o’. k. x);

m_S – tomonlar uzunligi burchak o’rta kvadratik xatosi (o’. k. x);

μ – uzunlik o’lchashda tasodifiy xatoning ta’sir koeffisiyenti;

η – uzunlik o’lchashda sistematik xatoning ta’sir koeffisiyenti;

f_β – poligonometriya yo’lining burchak xatoligi;

f_x, f_y, f_s – koordinata Δx va Δy orttirmalari, yo’lning umumiy uzunlik bo’yicha xatosi;

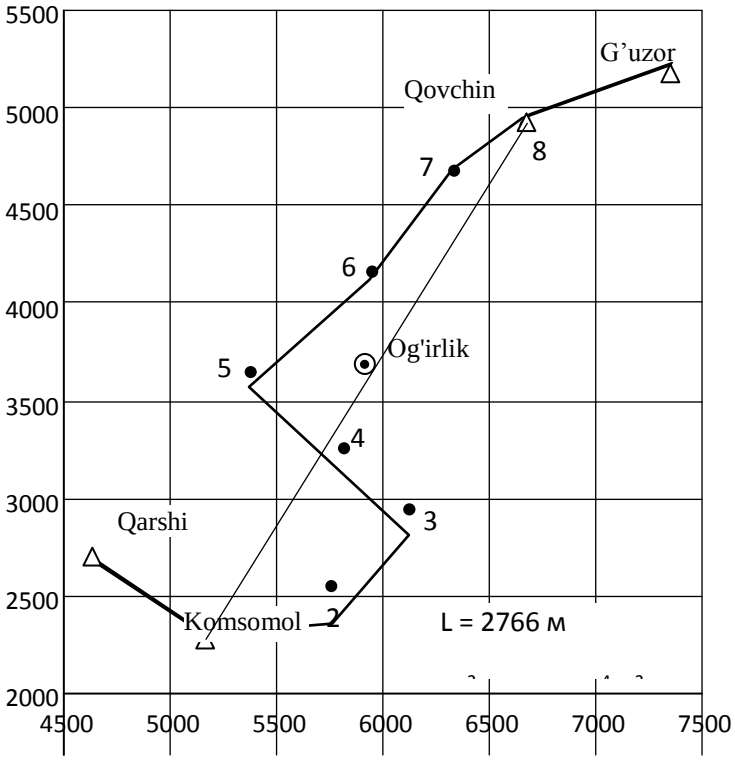
t – yo’lning bo’ylama xatosi;

u – yo’lning ko’ndalang xatosi;

m_t, m_u – yo’lning bo’ylama va ko’ndalang o’rta kvadratik nisbiy xatosi;

$\frac{1}{T}$ – chegaraviy nisbiy xatosi;

m'_u – koordinata orttirmalarini o’lchangan burchaklar bo’yicha hisoblanganda ko’ndalang o’rta kvadratik xatosi.



7 – shakl. Poligonomtriya to’rining sxemasi.

Poligonometriya to’rini parametrik usulda tenglashtirish va aniqligini baholash.

Komsomol va Qovchin poligonometriya punktlari orasidagi poligonometriya to’rini tenglashtirishni misol tariqasida ko’rib chiqamiz. Chap o’lchangan burilish burchak (β_i)lari va tomonlar uzunlik (S_i)lari, hamda tayanch punkt koordinatalari quyidagi 1– chi va 2– chi jadvallarida keltirilgan.

Burchaklar va tomon uzunliklari qiymatlari.

1–Jadval.

Punkt nomi.	Burilish burchaklari.	Tomon Uzunliklari, S_i.	Dala o’lchov aniqliklari.
Komsomol, 1.	$145^0 20^I 31^{II}$		
		460,153	
2	$138^0 15^I 42^{II}$		
		583,614	
3	$95^0 04^I 18^{II}$		$\mu = \pm 0{,}0004$
		335,216	$\lambda = 0{,}000020$
4	$178^0 35^I 05^{II}$		$m_\beta = 2^{II}$
		638,708	
5	$263^0 14^I 30^{II}$		
		702,911	
6	$181^0 19^I 52^{II}$		
		617,385	
7	$198^0 44^I 21^{II}$		
		400,555	
Qovchin, 8	$193^0 11^I 30^{II}$		

2–Jadval.

Direksion burchaklar.		Koordinatalar (m).			
Qarshi – Komsomol	Qovchin – G’uzor	Komsomol.		Qovchin.	
		X_K	Y_K	X_Q	Y_Q
$121^0 13^I 14^{II}$	$74^0 58^I 53^{II}$	2500	5200	4841,229	6673,463

Poligonometriya to’rini tenglashtirish uchun quyidagi matematik amallar bilan hisoblash ishlarini bajaramiz:

1.O’lchangan β_i burchaklarini 3–jadval (2–ustuniga) yig’amiz, ya’ni uning so’mmasi

$$\sum_{1}^{n+1} \beta_i = 1393^0 45^I 49^{II};$$

bo’ladi.

2.Burchak xatoligini quyidagi formula bilan hisoblaymiz, ya'ni:

$$f_\beta = \alpha_{bosh} + \sum_{1}^{n+1} \beta_i - (n+1)\cdot 180^0 - \alpha_{oxir}; \quad (1)$$

bu yerda: α_{bosh} va α_{oxir} – boshlang'ich va oxirgi tomonlar direksion burchaklari, ya'ni: $\alpha_{bosh.} = 121^0 13^I 14^{II}$, $\alpha_{oxir} = 74^0 58^I 53^{II}$; 1 – chi formulaga muvofiq,

$f_\beta = 121^0 13^I 14^{II} + 1393^0 \cdot 45^I 49^{II} - 8*180^0 - 74^0 58^I 53^{II} = +10^{II}$;

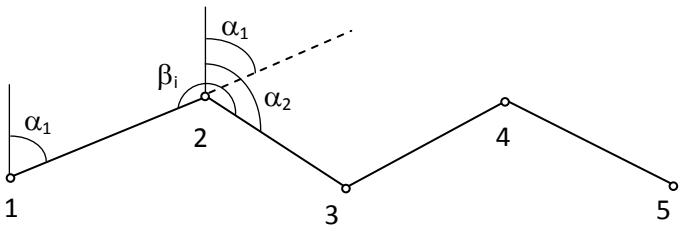
$$f_\beta^{chekli} = 2 * m_\beta \sqrt{n+1} = 4^{II}\sqrt{8} = 11^{II},3$$

$$f_\beta < f_\beta^{chekli};$$

3.Qilingan f_β xatolikni teskari ishora bilan o'lchangan burilish burchaklariga tarqatamiz (3–jadval, 2–chi ustun).

4.Boshlang'ich va oxirgi tomonlar direksion burchaklarining qiymatlari tegishli Qarshi – Komsomol va Qovchin – G'uzor tomonlari (8–shakl) bo'yicha hisoblanadi va 3 – chi jadvalga kiritilib, qolgan tomonlar direksion burchaklari quyidagi formula yordamida aniqlanadi.

$$\alpha_{n,n+1} = \alpha_{n-1,n} - 180^0 + \beta_i; \quad (2)$$



8 – shakl.

5.Koordinata orttirmalari quyidagi formulalar bo'yicha hisoblanadi.

$$\Delta x = S*\cos\alpha;$$

$$\Delta y = S*\sin\alpha.$$

Olingan natijalar 3 – chi jadvalning 5 – chi va 6 – chi ustunlariga kiritilib yoziladi.

6.Koordinata orttirmalari xatoliklarini quyidagi formulalar bo'yicha hisoblab chiqaramiz.

$$f_x = [\Delta x'] - (x_{oxir} - x_{bosh}) = 2341{,}221 - 2341{,}229 = -0{,}008 \text{ m};$$

$$f_y = [\Delta y'] - (y_{oxir} - y_{bosh}) = 1473{,}469 - 1473{,}463 = +0{,}006 \text{ m},$$

bu yerda: x_{oxir} va y_{oxir} – oxirgi nuqtalar koordinatalari,

x_{bosh} va y_{bosh} – boshlang'ich nuqtalar koordinatalari.

7.Uzunlik bo'yicha xatolik quyidagi shartni bajarishi kerak.

$$f_s = \pm\sqrt{f_x^2 + f_y^2} < f_S^{chek} = 2M;$$

$$M^2 = \mu^2[S] + \lambda^2 L^2 + \frac{m_\beta^2}{\rho^2} L^2 \frac{(n+3)}{12}$$

$$f_s = \sqrt{(-0{,}8)^2 + (0{,}6)^2} = 1{,}0 \text{ см} = 0{,}01 \text{ м}.$$

$$\frac{f_s}{3738{,}542} = \frac{0{,}01}{3738{,}542} = \frac{1}{373854} < \frac{1}{T} = \frac{1}{300000}$$

8. f_x va f_y xatolarini teskari ishora bilan tarqatib Δx va Δy qiymatlarini hisoblaymiz.

9.Poligonometriya nuqtalarining koordinatalarini quyidagi formula yordamida hisoblaymiz.

$$\left.\begin{aligned} x_i &= x_{i\text{-}1} + \Delta x \\ y_i &= y_{i\text{-}1} + \Delta y \end{aligned}\right\} \qquad (2)$$

Olingan natijalarni 3 – jadvalning 9 – chi va 10 – chi ustunlariga yozamiz.

Poligonometriya nuqtalarining koordinatalarini hisoblash qaytnomasi.

3–jadval.

Punktlar	Burilish burchaklari	Direksion burchaklar	Tomon uzunlik-lari	Koordinata orttirmalaria.				Koordinatalar.	
				Δx'	Δy'	Δx	Δy		
1	2	3	4	5	6	7	8	9	10
Qarshi		$121^0 13^I 14^{II}$							
Komsomol, 1	$145^0 20^I 31^{II}$			+0,001	-0,001			2500,00	5200,00
	-1	$86^0 33^I 44^{II}$	460,153	27,593	459,325	27,594	459,324		
2	$138^0 15^I 42^{II}$			+0,001	-0,001			2527,594	5659,324
	-1	$44^0 49^I 25^{II}$	583,614	413,946	411,405	413,947	411,404		
3	$95^0 04^I 18^{II}$			+0,002	-0,001			2941,541	6070,728
	-1	$319^0 53^I 42^{II}$	335,216	256,395	-215,943	256,397	-215,944		
4	$178^0 35^I 05^{II}$			+0,001	-0,001			3197,938	5854,784
	-2	$318^0 28^I 46^{II}$	638,708	478,216	-423,387	478,217	-423,388		
5	$263^0 14^I 30^{II}$			+0,001	-0,001			3676,155	5431,396
	-1	$41^0 43^I 14^{II}$	702,911	524,657	467,781	524,658	467,780		
6	$181^0 19^I 52^{II}$			+0,001	0			4200,813	5899,176
	-2	$43^0 03^I 05^{II}$	617,385	451,15	421,460	451,151	421,460		
7	$198^0 44^I 21^{II}$			+0,001	-0,001			4651,964	6320,636
	-1	$61^0 47^I 24^{II}$	400,385	189,264	352,828	189,265	352,827		
Qovchin, 8	$193^0 11^I 30^{II}$							4841,229	6673,463
G'uzor		$74^0 58^I 53^{II}$							
$\sum_1^{n+1} \beta_i = 1393^0 45^I 49^{II}$			ΣS_i= 3738,542 L = 2766	ΣΔx' = 2341,221	ΣΔy' = 1473,469	ΣΔx = 2341,229	ΣΔy = 1473,463		

$$f_\beta = \alpha_{bosh} + \sum_1^n \beta_i - (n+1)*180^0 - \alpha_{oxir} = +10'',$$

f_x = -0,008, f_y = +0,006, f_s = 0,01;

$$\frac{f_s}{S} = \frac{1}{3738542} < \frac{1}{25000}$$

Poligonometriya yo’lini tenglashtirish qaytnomasi.

4–Jadval.

Punkt-lar.	Shartli koordinatalar		ξ	η	ξ^2	ξ·η	η^2	Δ*x*·cosα	Δ*y*·cosα= Δ*x*·sinα	Δ*y*·sinα
	x'	*y*'								
1	2	3	4	5	6	7	8	9	10	11
1	500	200	-1067	-688	1138490	734096	473344			
								1,655	27,544	458,497
2	527	659	-1040	-229	1081600	238160	52441			
								293,60	291,802	290,01
3	941	1070	-626	182	391876	-113932	33124			
								196,11	-165,168	+139,108
4	1198	856	-369	-32	136161	11808	1024			
								358,05	-317,00	+280,656
5	1676	431	109	-457	11811	-49813	208849			
								391,61	349,155	311,30
6	2200	899	633	11	400689	6963	121			
								329,67	307,98	287,71
7	2652	1320	1085	432	1177220	468720	186624			
								89,46	166,784	310,92
8	2841	1673	1274	785	1623070	1000090	616225			
	12535	**7108**	+3101 -3102 -1	+1410 -1406 +4	5960911	2296092	1571752	1660,155	661,097	2078,20
	$x_м$=1567;$y_м$=888				$[\xi^2]$	$[\xi\cdot\eta]$	$[\eta^2]$			

$[D^2_{ц.i}] = [\xi^2] + [\eta^2] = 7532663;$

10.Poligonometriya nuqtalarining og’irlik markazi koordinatalarini quyidagi formula bo’yicha hisoblab chiqaramiz.

$$X_M = \frac{[x_i']}{n+1} = \frac{12535}{8} = 1567m;$$

$$y_M = \frac{[y_i']}{n+1} = \frac{7108}{8} = 888m;$$

bu yerda: $[x_i]$ = 12535 m, $[y_i]$ = 7108 m – shartli koordinatalar summasi (4-jadval, 2 va 3 ustunlar yig’indisi).

11. Og’irlik markazidan nuqtalargacha bo’lgan masofalarni quyidagi formulalar orqali aniqlaymiz.

$$\xi_i = x_i' - x_м \quad \eta_i = y_i' - y_м$$

Tekshirish: $[\xi_i] \approx 0$ va $[\eta_i] \approx 0$

12. Poligonometriya yo'lining shartli tenglamasi quyidagicha:

$$\left.\begin{aligned} [v''_\beta] &= 0 \\ [v_s \cos\alpha] + \frac{1}{\rho}[v''_\beta \eta] + f_x &= 0 \\ [v_s \sin\alpha] - \frac{1}{\rho}[v''\beta\xi] + f_y &= 0 \end{aligned}\right\} \qquad (3)$$

bu yerda: v''_β - o’lchangan burchaklar uchun kiritiladigan ikkinchi tuzatma.

13. Tomon va burchaklar vazni quyidagicha hisoblanadi.

$$p_{s_i}=\frac{1}{S_i};\quad p_{\beta_i}=\frac{\mu^2}{m_\beta^{\,2}}=p;\quad p=\frac{0{,}0004^2}{2^2}=4\cdot10^{-8};\quad q=\frac{1}{p\cdot\rho}=\frac{1}{4\cdot10^{-8}\cdot206265''}=121{,}20$$

q – teskari vazn,

ρ - radianning sekundagi miqdori, ya'ni $\rho=\frac{180^0}{\pi}=57^0{,}29578=206264''{,}8$

14. Korrelat normal tenglamalari koeffisiyentlari.

$$\left.\begin{aligned}
\left[\frac{aa}{p}\right]&=\frac{n+1}{p},\\
\left[\frac{ab}{p}\right]&=q[\eta]=0,\\
\left[\frac{ac}{p}\right]&=-q[\xi]=0,\\
\left[\frac{bb}{p}\right]&=\frac{q}{\rho}[\eta^2]+[\Delta x\cos\alpha]=A\\
\left[\frac{bc}{p}\right]&=-\frac{q}{\rho}[\eta\xi]+[\Delta x\sin\alpha]=C\\
\left[\frac{cc}{p}\right]&=\frac{q}{\rho}[\xi^2]+[\Delta y\cdot sin\alpha]=B
\end{aligned}\right\}\qquad(4)$$

bu yerda: $q=\frac{1}{p*\rho''}$

15. Tekshirish:

$$[(\eta+\xi)^2]=[\eta^2]+[\xi^2]+2[\eta\xi]$$
$$\Delta x_i\cos\alpha_i+\Delta y_i\sin\alpha_i=S_i$$
$$\Delta x_i\sin\alpha_i=\Delta y_i\cos\alpha_i$$

16. Normal tenglama ko'rinishida quyidagicha bo'ladi.

$$\left.\begin{aligned}
\frac{n+1}{P}k_1+q[\eta]k_2+q[\xi]k_3&=0\\
q[\eta]k_1+Ak_2+Ck_3+f_x&=0\\
q[\xi]k_1+Ck_2+Bk_3+f_y&=0
\end{aligned}\right\}\quad(5)$$

yoki,

$$\left.\begin{aligned}
\frac{8}{p}*k_1&=0\\
Ak_2+Ck_3+f_x&=0\\
Ck_2+Bk_3+f_y&=0
\end{aligned}\right\}$$

bu yerdan

$$\left.\begin{aligned}
k_1&=0\\
k_2&=\frac{1}{N}(Cf_y-Bf_x)\\
k_3&=\frac{1}{N}(Cf_x-Af_y)
\end{aligned}\right\}\qquad(6)$$

$$N = AB - C^2$$

4 chi formulalarga muvofiq:

$$A = 0{,}000587 * 1571752 + 1660{,}155 = 2583{,}706$$
$$C = -0{,}000587 * 2296092 + 661{,}097 = -688{,}072$$
$$B = 0{,}000587 * 5960911 + 2078{,}20 = 5580{,}8$$
$$N = AB - C^2 = 14419148 - 473443 = 13945705$$

17. Olingan natijalarni 6 – chi formulaga quyidagilarni hisoblaymiz.

$$k_1 = 0$$
$$k_2 = \frac{(-688{,}072) * 0{,}006 - 5580{,}8 * (-0{,}008)}{13945705} = \frac{-4{,}12 + 44{,}64}{13945705} = 2{,}90 \cdot 10^{-6} = 0{,}0000029$$
$$k_3 = \frac{(-688{,}072) * (-0{,}008) - 2583{,}706 * (0{,}006)}{13945705} = \frac{55{,}0457 - 15{,}50}{13945705} = 2{,}83 \cdot 10^{-6} = 0{,}00000283$$

18.O'lchangan burchak, direksion burchak va tomonlarga tuzatmalar quyidagi formulalar yordamida hisoblanadi.

$$\left.\begin{aligned} v''_{\beta_i} &= \eta_i q k_2 - \xi_i q k_3 \\ v''_{\alpha i} &= \sum_i^{n+1} v''_{\beta_i} \\ v''_{Si} &= \Delta x_i k_2 + \Delta y_i k_3 \end{aligned}\right\} \qquad (7)$$

Hisoblangan natijalar 5 – chi jadvalning (3 – 9) ustunlariga kiritiladi.

19. Hisoblangan natijalarni tekshirish.

$$\left[v''_{\beta_i}\right] = 0$$
$$\left[v''_{Si}\right] = [\Delta x] k_2 + [\Delta y] k_3$$
$$\left[v''_{si}\right] = 2341{,}229 * 0{,}0000029 + 1473{,}463 * 0{,}00000283$$
$$0{,}011 = 0{,}00678 + 0{,}00412$$
$$0{,}011 = 0{,}0109;$$
$$0{,}011 = 0{,}011.$$

20. Koordinata orttirmalariga kiritiladigan tuzatma quyidagi formula yordamida hisoblanadi.

$$\left.\begin{aligned} v_{\Delta x} &= v''_s * \cos\alpha - \frac{v''_\alpha}{\rho} \Delta y_i \\ v_{\Delta y} &= v''_s * \sin\alpha - \frac{v_\alpha}{\rho} \Delta x_i \end{aligned}\right\} \qquad (8)$$

21. Tekshirish. $\left[v_{\Delta x}\right] = -f_x$ va $\left[v_{\Delta y}\right] = -f_y$ (9)

22. Vazn birligi o'rta kvadraik xatoligi quyidagi formula yordamida hisoblanadi.

$$\mu = \pm\sqrt{\frac{P\frac{f_\beta^2}{n+1} + P\left[v''^2_\beta\right] + \left[\frac{1}{S} v_S^2\right]}{3}}; \qquad (10)$$

23. Poligonometriya yo'li tenglashtirilgan elementlari funksiyalarining o'rtacha kvadratik xatoligi quyidagi formula yordamida hisoblanadi.

$$M_u = \mu\sqrt{\frac{1}{P_u}}\ ; (11)$$

bu yerda: μ – vazn birligi o'rta kvadratik xatoligi;

$\frac{1}{P_u}$ - funksiyaning teskari vazni, u quyidagi formula bilan hisoblanadi.

$$\frac{1}{P_u} = \left[\frac{EF}{P}\right] - P\frac{\left[\frac{aF}{p}\right]^2}{n+1} - \frac{\left[\frac{bF}{p}\right]^2}{A} - \frac{\left\{\left[\frac{cF}{p}\right] - \frac{C}{A}\left[\frac{bF}{p}\right]^2\right\}}{B - \frac{C^2}{A}}\ ; (12)$$

Poligonometriya yo'li nuqtalarining koordinatalari, direksion burchaklari, tomonlarining o'rta kvadratik xatoliklari va teskari vaznlarini hisoblash formulalari 5 – chi jadvalda berilgan.

5 – chi jadval uchun kerak bo'lgan ma'lumotlar:

λ=0,000020 A=+2584 $1000\frac{q}{\rho} = 0{,}5876$

μ = 0,0004 C = - 688

m_β= 2" B = +5581 $\frac{AB}{1000} = +14419$

ρ=4*10^{-8} N = 13945705

q = 121,2 $-\frac{C^2}{1000} = -473$

$\frac{N}{1000} = +13946$

5 – Jadval.

№	q	$\eta_i q k_2$	$\xi_i q k_3$	v''_{β_i}	v''_{α_i}	$\Delta x_i k_2 \cdot 1000$	$\Delta y_i k_3 \cdot 1000$	v''_s (мм)
1	2	3	4	5	6	7	8	9
1	121,2	-0,242	-0,362	0,121				
					0,121	0,08	1,30	1,38
2	121,2	-0,080	-0,353	0,273				
					+0,394	1,20	1,16	2,36
3	121,2	0,0640	-0,215	0,279				
					0,673	0,743	-0,608	0.135
4	121,2	-0,0112	-0,126	0,114				
					0,787	1,386	-1,20	0,19
5	121,2	-0,160	+0,0374	-0,197				
					0,590	1,52	1,32	2,84
6	121,2	0,00387	+0,217	-0,213				
					+0,377	1,31	1,2	2,51
7	121,2	0,152	+0,372	-0,220				
					+0,157	0,548	0,998	1,546
8	121,2	0,276	+0,437	-0,161				

$\left[v_{\beta i}\right] = 0$ 11 mm;

Cf_y= -4,0	–	Cf_X= +6	
$-Bf_x$= +45		Af_y= -16	
$Cf_y - Bf_x$= -49		$Cf_X - Af_y$= +22	
$1000k_2$ = 0,0029		$1000k_3$ = 0,00283	
qk_2 = -0,3515		qk_3 = 0,3430	

5 – Jadvalning davomi.

$\frac{v_\alpha''}{\rho} * 1000$	$v_s'' * \cos\alpha$	$\frac{v_\alpha''}{\rho} * * \Delta y * 1000$	tuzatma $v_{\Delta x}$	$v_s'' * \sin\alpha$	$\frac{v_\alpha''}{\rho} * * \Delta x * 1000$	Tuzatma $v_{\Delta y}$
10	11	12	13	14	15	16
0,000586	0,0827	0,270	-0,269	1,1516	0,016	1,1676
0,00191	1,674	0,7850	-0,783	0,6038	0,791	1,3948
0,00326	0,103	+0,7040	-0,701	-0,1269	0,836	0,7091
0,00381	0,142	+1,61	-0,138	-0,1802	1,822	1,6418
0,00286	2,12	1,33	-1,327	0,5769	1,500	2,0769
0,00182	1,83	0,767	-0,765	0,5668	0,821	1,3878
+0,000761	0,73	+0,268	-0,268	0,4616	0,144	0,6056

ILOVALAR:

6–Jadval.

Elementlar-ning nomlanishi.	β_t burchak	α_i Direksion burchak	S_i Tomon uzunligi.	Absissa, x_i	Ordinata, y_i
1	2	3	4	5	6
$\left[\frac{EF}{p}\right]$		$\frac{i}{P}$	S_i	$\frac{q}{\rho}\,[(y_{i+1}-y)^2]_1^t + [Scos^2\alpha]_1^t$	$\frac{q}{\rho}\,[(x_{i+1}-x)^2]_1^t + [Ssin^2\alpha]_1^t$
$\left[\frac{\alpha F}{p}\right]$		$\frac{i}{P}$	0	$-q\,[(y_{i+1}-y)^2]_1^t$	$-[(x_{i+1}-x)^2]_1^t$
$\left[\frac{bF}{p}\right]$	q EMBED Equation.3	EMBED Equation.3	EMBED Equation.3	EMBED Equation.3	EMBED Equation.3 $+ [Ssinacosa]_1^t$
$\left[\frac{cF}{p}\right]$	$-q$ EMBED Equation.3	EMBED Equation.3	EMBED Equation.3	EMBED Equation.3	EMBED Equation.3 $+ [Ssin^2\alpha]_1^t$

7 – Jadval.

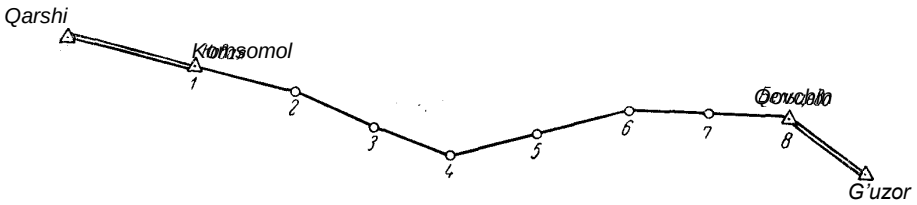
Punktlar	$\left[\frac{\alpha F}{p}\right]$	$\left[\frac{bF}{p}\right]$	$\left[\frac{cF}{p}\right]$	$\left[-\frac{\mathbf{C}}{\mathbf{A}}\left[\frac{bF}{p}\right]\right]$	$\left[\left[\frac{cF}{p}\right]-\frac{\mathbf{C}}{\mathbf{A}}\left[\frac{bF}{p}\right]\right]$	$\left[\frac{FF}{p}\right]$	$-\mathbf{P}\frac{\left[\frac{\alpha F}{p}\right]^2}{n+1}$	$\frac{\left[\frac{bF}{p}\right]^2}{A}$	$\frac{\left[\left[\frac{cF}{p}\right]-\frac{\mathbf{C}}{\mathbf{A}}\left[\frac{bF}{p}\right]^2\right]}{B-\frac{\mathbf{C}^2}{\mathbf{A}}}$		m_u
Tenglashtirilgan direksion burchaklarning aniqligini baholash.											
3	$8*10^7$	$9*10^4$	$33*10^4$	$-2*10^4$	$31*10^4$	$8*10^7$	$-3*10^7$	$-0*10^7$	$-2*10^7$	$3*10^7$	±2,2
4	$10*10^7$	$9*10^4$	$38*10^4$	$-2*10^4$	$36*10^4$	$10*10^7$	$-5*10^7$	$-0*10^7$	$-2*10^7$	$3*10^7$	±2,2
Tenglashtirilgan absissalar aniqligini baholash.											
3	$8*10^4$	$8*10^2$	$12*10^2$	$-2*10^2$	$10*10^2$	$8*10^2$	$0*10^2$	$-2*10^2$	$0*10^1$	$6*10^2$	±0,01
4	$13*10^4$	$13*10^2$	$21*10^2$	$-3*10^2$	$18*10^2$	$13*10^2$	$-1*10^2$	$-7*10^2$	$-6*10^2$	$-1*10^2$	±0,004
Tenglashtirilgan ordinatalar aniqligini baholash.											
3	$20*10^4$	$9*10^2$	$35*10^2$	$-2*10^2$	$33*10^2$	$17*10^2$	$-2*10^2$	$-3*10^2$	$-20*10^2$	$-8*10^2$	±0,011
4	$43*10^4$	$18*10^2$	$76*10^2$	$-5*10^2$	$71*10^2$	$39*10^2$	$-9*10^2$	$-13*10^2$	$-93*10^2$	$-3*10^2$	±0,034

8 – Jadval.

i	3	4
$y_{i+1}-y_1$	655	231
$y_{i+1}-y_2$	196	-228
$y_{i+1}-y_3$	-216	-640
$y_{i+1}-y_4$		-424
$\sum$	635	-1061
$x_{i+1}-x_1$	698	1176
$x_{i+1}-x_2$	670	1148
$x_{i+1}-x_3$	256	734
$x_{i+1}-x_4$		478
$\sum$	1624	3536
$\left[S*\cos^2\alpha\right]$	492	850
$\left[S*\sin\alpha*\cos\alpha\right]$	+154	-163
$\left[S*\sin^2\alpha\right]$	887	1167
$[n]$	-735	-767
$[\xi]$	-2733	-3102

$\frac{C}{A}=0{,}266$; $B-\frac{C^2}{A}=5398$.

Kurs ishini bajarish uchun topshiriqlar.



3 – shakl.

Talabalar uchun beriladigan Kurs ishi variantlari.

9 – Jadval.

Variantlar .	Direksion burchaklar.		Koordinatalar.			
	Qarshi – Komsomol $\alpha_б$	Qovchin – G'uzor α_0	Komsomol		Qovchin	
			x	*y*	*x*	*y*
1	**2**	**3**	**4**	**5**	**6**	**7**
1	113° 28' 37"	159° 14' 10"	10901,025	7050,400	9619,164	9076,842
2	114° 39' 39"	160° 25' 12"	10901,025	7050,400	9577,568	9049,925
3	116° 59' 39"	162° 45' 12"	10901,025	7050,400	9497,260	8994,384
4	120° 29' 39"	166° 15' 12"	10901,025	7050,400	9381,200	8905,062
5	122° 49' 39"	168° 35' 12"	10901,025	7050,400	9306,951	8841,646
6	125° 09' 39"	170° 55' 12"	10901,025	7050,400	9235,346	8775,262
7	130° 59' 39"	176° 45' 12"	10901,025	7050,400	9068,665	8597,038
8	133° 19' 39"	179° 05' 12"	10901,025	7050,400	9007,216	8521,156
9	136° 49' 39"	182° 35' 12"	10901,025	7050,400	8920,961	8402,798
10	140° 19' 39"	186° 05' 12"	10901,025	7050,400	8842,091	8279,396
11	144° 21' 39"	190° 33' 12"	10901,025	7050,400	8705,191	8205,196
12	147° 25' 39"	192° 48' 12"	10901,025	7050,400	8693,291	8168,313
13	149° 39' 39"	194° 44' 12"	10901,025	7050,400	8516,191	7998,415
14	151° 32' 39"	196° 34' 12"	10901,025	7050,400	8496,781	7855,555
15	153° 25' 39"	198° 55' 12"	10901,025	7050,400	8397,113	7675,613
16	154° 59' 39"	200° 15' 12"	10901,025	7050,400	8288,513	7483,815
17	156° 42' 39"	202° 33' 12"	10901,025	7050,400	8175,613	7317,555
18	158° 28' 39"	204° 45' 12"	10901,025	7050,400	8058,115	7283,657
19	160° 37' 39"	206° 07' 12"	10901,025	7050,400	7983,615	7193,765
20	163° 47' 39"	209° 15' 12"	10901,025	7050,400	7868,788	7085,683
21	167° 45' 39"	211° 33' 12"	10901,025	7050,400	7778,613	6967,675
22	170° 55' 39"	214° 05' 12"	10901,025	7050,400	7671,543	6887,313
23	172° 47' 39"	217° 15' 12"	10901,025	7050,400	7556,345	6793,444
24	174° 28' 39"	221° 20' 12"	10901,025	7050,400	7467,643	6688,614
25	175° 55' 39"	223° 33' 12"	10901,025	7050,400	7389,605	6583,113
26	177° 59' 39"	225° 45' 12"	10901,025	7050,400	9014,313	8514,213
27	180° 29' 39"	227° 25' 12"	10901,025	7050,400	8963,818	8475,555
28	182° 55' 39"	229° 33' 12"	10901,025	7050,400	8783,913	8293,613
29	184° 39' 39"	231° 45' 12"	10901,025	7050,400	8619,815	8188,413
30	187° 44' 39"	234° 05' 12"	10901,025	7050,400	8428,115	7993,215
31	191° 55' 39"	236° 15' 12"	10901,025	7050,400	8256,615	7583,618
32	193° 44' 39"	238° 33' 12"	10901,025	7050,400	8086,115	7498,113

1	2	3	4	5	6	7
33	73°30' 59"	125°50' 47"	6385,808	4108,000	7174,295	7710,303
34	73°10' 58"	125°30' 46"	6385,808	4108,000	7195,255	7705,649
35	72°50' 57"	125°10' 45"	6385,808	4108,000	7216,186	7700,878
36	72°30' 56"	124°50' 44"	6385,808	4108,000	7237,095	7695,981
37	72°10' 55"	124°30' 43"	6385,808	4108,000	7257,970	7690,962
38	71°50' 54"	124°10' 42"	6385,808	4108,000	7278,816	7685,825
39	71°30' 53"	123°50' 41"	6385,808	4108,000	7299,636	7680,563
40	71°10' 52"	123°30' 40"	6385,808	4108,000	7320,423	7675,183
41	70°50' 51"	123°10' 39"	6385,808	4108,000	7341,173	7669,677
42	70°10' 49"	122°30' 37"	6385,808	4108,000	7382,585	7658,312
43	83°40' 59"	135°30' 47"	6385,808	4108,000	7274,295	7810,303
44	83°25' 58"	135°35' 46"	6385,808	4108,000	7295,255	7805,649
45	82°35' 57"	135°25' 45"	6385,808	4108,000	7316,186	7800,878
46	82°20' 56"	134°40' 44"	6385,808	4108,000	7337,095	7795,981
47	82°40' 55"	134°20' 43"	6385,808	4108,000	7357,970	7790,962
48	81°55' 54"	134°15' 42"	6385,808	4108,000	7378,816	7785,825
49	81°35' 53"	133°45' 41"	6385,808	4108,000	7399,636	7780,563
50	81°15' 52"	133°35' 40"	6385,808	4108,000	7420,423	7775,183

10 – Jadval.

Punktlar.	Burilish burchaklari (chap), β	Masofa uzunligi, S, м	Dala aniqliklari.
Komsomol, 1	181° 05' 47"	552,007	$\mu = \pm 0{,}0002$
2	247° 51' 08"	565,338	$\lambda = 0{,}000008$
3	156° 32' 35"	339,025	$m_\mu = \pm 3",5$
4	139° 20' 11"	400,408	
5	157° 18' 32"	356,831	
6	170° 06' 59"	372,263	
7	179° 59' 41"	348,716	
Qovchin, 8	253° 30' 32"		

Foydalanilgan adabiyotlar.

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