

*** 7-mavzu. Chiziqli
tenglamalar sistemasi.**

7.1.

**Kramer
formulasi.**

* Noma”lumlar koeffisientlaridan tuzilgan determinant tenglamalar sisremasinining asosiy determinanti, undagi j-ustun o’rniga ozod hadlardan iborat ustun qo’yilgan determinant esa j-yordamchi determinant deyiladi va ko’rinishida belgilanadi.

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$$a_{11} \dots a_{1j-1} b_1 \quad a_{1j+1} \dots a_{1n}$$

$$a_{21} \dots a_{2j-1} b_2 \quad a_{2j+1} \dots a_{2n}$$

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$$\Delta_j = \dots \dots \dots$$

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$$a_{n1} \dots a_{nj-1} b_n \quad a_{nj+1} \dots a_{nn}$$

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* Dastlab, berilgan tenglamalar sistemasidan har bir i-tenglamani ko’paytiramiz va hosil bo’lgan tenglamalarni qo’shamiz:

* Determinantni yoyish haqidagi teoremaga ko’ra: .Endi sistamadagi har bir i-tenglama ga ko’paytirilib qo’shilsa, ,..., qo’shilsa, tenglik hosil bo’ladi.

* Demak, sistemadagi noma”lumlar formula yordamida xisoblanar ekan. Bu Kramer formulasidir.

* tenglikdan quyidagilar kelib chiqadi:

* da sistema yagona echimga ega, uni birgalikda deyiladi.

* bo’lsa, sistema cheksiz ko’p echimga ega.

Misol. Kram $\Delta=0$,er formulasi yordamida yeching:

$$\begin{cases} x_1 + x_2 + x_3 - x_4 = 2 \\ x_1 + 2x_2 + 3x_3 - 4x_4 = -2 \\ 2x_1 + x_2 - x_3 + x_4 = 5 \\ 4x_1 + 3x_2 + 2x_3 - 4x_4 = 0 \end{cases} \quad \Delta = \begin{vmatrix} 1 & 1 & 1 & -1 \\ 1 & 2 & 3 & -4 \\ 2 & 1 & -1 & 1 \\ 4 & 3 & 2 & -4 \end{vmatrix} = 3,$$

$$\Delta_1 = \begin{vmatrix} 2 & 1 & 1 & -1 \\ -2 & 2 & 3 & -4 \\ 5 & 1 & -1 & 1 \\ 0 & 3 & 2 & -4 \end{vmatrix} = 3, \quad \Delta_2 = \begin{vmatrix} 1 & 2 & 1 & -1 \\ 1 & -2 & 3 & -4 \\ 2 & 2 & -1 & 1 \\ 4 & 0 & 2 & -4 \end{vmatrix} = 6,$$

$$\Delta_3 = \begin{vmatrix} 1 & 1 & 2 & -1 \\ 1 & 2 & -2 & -4 \\ 2 & 1 & 5 & 1 \\ 4 & 3 & 0 & -4 \end{vmatrix} = 9, \quad \Delta_4 = \begin{vmatrix} 1 & 1 & 1 & 2 \\ 1 & 2 & 3 & -2 \\ 2 & 1 & -1 & 5 \\ 4 & 3 & 2 & 0 \end{vmatrix} = 12 \quad \text{bo'lganligi uchun}$$

$$x_1 = 1, x_2 = 2, x_3 = 3, x_4 = 4.$$

***7 2.**

**Matrisaviy
usulda echish.**

Berilgan tenglamalar sistemasini matrisaviy

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \cdot & \cdot & \dots & \cdot \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix} \cdot \begin{pmatrix} x_1 \\ x_2 \\ \dots \\ x_n \end{pmatrix} = \begin{pmatrix} b_1 \\ b_2 \\ \dots \\ b_n \end{pmatrix} \quad \text{yoki} \quad A \cdot X = B \quad \text{ko'rinishida yozish}$$

mumkin.

Agar $|A| \neq 0$ bo'lsa, A^{-1} matrisa mavjud va yagona bo'lishidan $A^{-1} \cdot A \cdot X = A^{-1} \cdot B$ yoki $X = A^{-1} \cdot B$.

Nomalumlardan iborat X -ustun matrisani bunday topish matrisaviy usul deyiladi.

Misol. Yuqoridagi sistemani shu usulda qayta echamiz.

$|A| = \Delta = 3$ ekanligini hisoblaganmiz.

$$A = \begin{vmatrix} 1 & 1 & 1 & -1 \\ 1 & 2 & 3 & -4 \\ 2 & 1 & -1 & 1 \\ 4 & 3 & 2 & -4 \end{vmatrix} \text{ matrisaga teskari } A^{-1} \text{ ni topamiz.}$$

$$A_{11} = \begin{vmatrix} 2 & 3 & -4 \\ 1 & -1 & 1 \\ 3 & 2 & -4 \end{vmatrix} = 5; \quad A_{21} = \begin{vmatrix} 1 & 1 & -1 \\ 1 & -1 & 1 \\ 3 & 2 & -4 \end{vmatrix} = -4; \quad A_{31} = \begin{vmatrix} 1 & 1 & -1 \\ 2 & 3 & -4 \\ 3 & 2 & -4 \end{vmatrix} = -3; \quad A_{41} = \begin{vmatrix} 1 & 1 & -1 \\ 2 & 3 & -4 \\ 2 & -1 & 1 \end{vmatrix} = 2$$

$$A_{12} = -\begin{vmatrix} 1 & 3 & -4 \\ 2 & -1 & 1 \\ 4 & 2 & -4 \end{vmatrix} = -6; \quad A_{22} = \begin{vmatrix} 1 & 1 & -1 \\ 2 & -1 & 1 \\ 4 & 2 & -4 \end{vmatrix} = 6; \quad A_{32} = -\begin{vmatrix} 1 & 1 & -1 \\ 1 & 3 & -4 \\ 4 & 2 & -4 \end{vmatrix} = 6; \quad A_{42} = \begin{vmatrix} 1 & 1 & -1 \\ 1 & 3 & -4 \\ 2 & -1 & 1 \end{vmatrix} = -3$$

$$A_{13} = \begin{vmatrix} 1 & 2 & -4 \\ 2 & 1 & 1 \\ 4 & 3 & -4 \end{vmatrix} = 9; \quad A_{23} = -\begin{vmatrix} 1 & 1 & -1 \\ 2 & 1 & 1 \\ 4 & 3 & -4 \end{vmatrix} = -3; \quad A_{33} = \begin{vmatrix} 1 & 1 & -1 \\ 1 & 2 & -4 \\ 4 & 3 & -4 \end{vmatrix} = -3; \quad A_{43} = \begin{vmatrix} 1 & 1 & -1 \\ 1 & 2 & -4 \\ 2 & 1 & 1 \end{vmatrix} = -2;$$

$$A_{14} = - \begin{vmatrix} 1 & 2 & 3 \\ 2 & 1 & -1 \\ 4 & 3 & 2 \end{vmatrix} = 5; \quad A_{24} = \begin{vmatrix} 1 & 1 & 1 \\ 2 & 1 & -1 \\ 4 & 3 & 2 \end{vmatrix} = -1; \quad A_{34} = - \begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 4 & 3 & 2 \end{vmatrix} = 0; \quad A_{44} = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 2 & 1 & -1 \end{vmatrix} = -1$$

Demak, $A^{-1} = \frac{1}{3} \begin{vmatrix} 5 & -4 & -3 & 2 \\ -6 & 6 & 6 & -3 \\ 9 & -3 & -3 & -2 \\ 5 & -1 & 0 & -1 \end{vmatrix}$

$$X = A^{-1} \cdot B = \frac{1}{3} \begin{pmatrix} 5 & -4 & -3 & 2 \\ -6 & 6 & 6 & -3 \\ 9 & -3 & -3 & -2 \\ 5 & -1 & 0 & -1 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ -2 \\ 5 \\ 0 \end{pmatrix} = \frac{1}{3} \begin{pmatrix} 3 \\ 6 \\ 9 \\ 12 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix}.$$

$$X = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix}, \text{ ya'ni } x_1 = 1, x_2 = 2, x_3 = 3, x_4 = 4.$$

***7.3.**

**Noma'lumlarni
ketma-ket yo'qotish
(Gauss) usuli.**

* Berilgan chiziqli tenglamalar sistemasi koeffisientlari orqali quyidagi jadvalni tuzib olamiz.

* Bu jadval berilgan sistema kengaytirilgan matrisasi deyiladi.

* Tushunarliki, har bir satrda bittadan tenglama turibdi, faqat tenglik o'rniga chiziqcha tortilgan.

* Bu matrisa ustida o'tkaziladigan har bir elementar almashtirish berilgan sistemaga ekvivalent sistema hosil qiladi. Shu sababli, elementar almashtirishlar yordamida kengaytirilgan matritsani uchburchak ko'rinishiga keltirib olamiz, buning uchun bo'lishi kifoya agar bo'lsa, birinchi tenglamani boshqa yo'ldagi tenglama bilan almashtirish orqali bunga erishish mumkin.

* Faraz qilaylik, elementar almashtirishlar yordamida kengaytirilgan matritsa ko'rinishga kelsin.

* Unga mos sistema

$$\left. \begin{array}{l} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \dots + a_{1n}x_n = b_1 \\ C_{22}x_2 + C_{23}x_3 + \dots + C_{2n}x_n = C_2 \\ C_{32}x_2 + \dots + C_{3n}x_n = C_3 \\ \dots \dots \dots \dots \dots \dots \dots \dots \\ C_{nn}x_n = C_n \end{array} \right) \text{ ko'rinishida bo'ladi.}$$

Bu sistemadan dastlab x_n , so'ngra x_{n-1}, \dots , va nihoyat x_1 topiladi.

Bu usulda 2-tenglamadan x_1 , ni 3-tenglamadan x_1 va x_2, \dots, n - tenglamadan x_1, x_2, \dots, x_{n-1} ketma - ket yo'qotilayotganligi uchun noma'lumlarni ketma - ket yo'qotish usuli deyiladi. Bu usul Gauss nomi bilan bog'liq bo'lib, talabalarga elementar matematikadan ma'lum.

Misol. Avvalgi usullarda yechilgan sistemani qaraylik. Uning kengaytirilgan

matritsasi $\left(\begin{array}{cccc|c} 1 & 1 & 1 & -1 & 1 \\ 1 & 2 & 3 & -4 & -2 \\ 2 & 1 & -1 & 1 & 5 \\ 4 & 3 & 2 & -4 & 0 \end{array} \right)$ ko'rinishda bo'ladi. 1- yo'l elementlarini (-1) ga

ko'paytirib 2-yo'lga (-2) ga ko'paytirib 3-yo'lga, (-4) ga ko'paytirib 4- yo'lga qo'shamiz, natijada, kengaytirilgan matritsa.

$$\left(\begin{array}{cccc|c} 1 & 1 & 1 & -1 & 2 \\ 0 & 1 & 2 & -3 & -4 \\ 0 & -1 & -3 & 3 & 1 \\ 0 & -1 & -2 & 0 & -8 \end{array} \right) \text{ ko'rinishiga keladi. 2 yo'lni 3, 4 -yo'l elementlariga qo'shamiz.}$$

$$\left(\begin{array}{cccc|c} 1 & 1 & 1 & -1 & 2 \\ 0 & 1 & 2 & -3 & -4 \\ 0 & 0 & -1 & 0 & -3 \\ 0 & 0 & 0 & -3 & -12 \end{array} \right)$$

Bu matritsaga mos sistema.
$$\left. \begin{array}{l} x_1 + x_2 + x_3 - x_4 = 2 \\ x_2 + 2x_3 - 3x_4 = -4 \\ -x_3 = -3 \\ -3x_4 = -12 \end{array} \right)$$

Ko'rinishida bo'ladi. Ketma-ket $x_4 = 4; x_3 = 3$ larni topib 2-tenglamaga qo'yamiz.

$$x_2 + 2 \cdot 3 - 3 \cdot 4 = -4,$$

Bu erdan $x_2 = 2$ ekanligini topib, 1-tenglamaga o'tamiz.

$$x_1 + 2 + 3 - 4 = 2 . \text{ Demak , } x_1 = 1 .$$

***7.4. Bir
jinsli
sistemalar.**

Teorema. (Kroneker-Kopelli): Tenglamalar sistemasi birgalikda bo'lishi uchun A va \bar{A} matritsalar ranglari teng $\text{rang}A = \text{rang}\bar{A}$ bo'lishi zarur.

Mavzuga doir misol va masalalar.

1. Determinantlar hisoblansin.

$$1). \begin{vmatrix} 5 & 4 \\ 3 & -2 \end{vmatrix} \quad 2). \begin{vmatrix} \sin\alpha & -\cos\alpha \\ \cos\alpha & \sin\alpha \end{vmatrix} \quad 3). \begin{vmatrix} \sin^2\alpha & \cos^2\alpha \\ \sin^2\beta & \cos^2\beta \end{vmatrix} \quad 4). \begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$$

$$5). \begin{vmatrix} 3 & 4 & -5 \\ 8 & 7 & -2 \\ 2 & -1 & 8 \end{vmatrix}$$

Nollari ko'p qator elementlari bo'yicha yoyib hisoblang:

$$1). \begin{vmatrix} 1 & b & 1 \\ 0 & b & 0 \\ b & 0 & -b \end{vmatrix} \quad 2). \begin{vmatrix} -x & 1 & x \\ 0 & -x & -1 \\ x & 1 & -x \end{vmatrix} \quad 3). \begin{vmatrix} 1 & 0 & 0 \\ -2 & -3 & 1 \\ 3 & 8 & -2 \end{vmatrix}$$

Tenglamalarni yeching:

$$1). \begin{vmatrix} 3 & x & -x \\ 2 & -1 & 3 \\ x+10 & 1 & 1 \end{vmatrix} = 0; \quad 2). \begin{vmatrix} x & x+1 & x+2 \\ x+3 & x+4 & x+5 \\ x+6 & x+7 & x+8 \end{vmatrix} = 0;$$

$$3). \begin{vmatrix} \cos 8x & -\sin 5x \\ \sin 8x & \cos 5x \end{vmatrix} = 0$$

4. Determinant kossalaridan foydalanib hisoblang:

$$1). \begin{vmatrix} \sin^2\alpha & 1 & \cos^2\alpha \\ \sin^2\beta & 1 & \cos^2\beta \\ \sin^2\gamma & 1 & \cos^2\gamma \end{vmatrix} \quad 2). \begin{vmatrix} \sin^2\alpha & \cos 2\alpha & \cos^2\alpha \\ \sin^2\beta & \cos 2\beta & \cos^2\beta \\ \sin^2\gamma & \cos 2\gamma & \cos^2\gamma \end{vmatrix}$$

$$3). \begin{vmatrix} (a_1 + b_1)^2 & a_1^2 + b_1^2 & a_1 b_1 \\ (a_2 + b_2)^2 & a_2^2 + b_2^2 & a_2 b_2 \\ (a_3 + b_3)^2 & a_3^2 + b_3^2 & a_3 b_3 \end{vmatrix}$$

5. Determinant kossalaridan foydalanib hisoblang:

$$1). \begin{vmatrix} 1 & 1 & 1 & 1 & 0 \\ 1 & -1 & 1 & 1 & 1 \\ 1 & 1 & -1 & 1 & 1 \\ 1 & 1 & 1 & 1 & -1 \end{vmatrix} \quad 2). \begin{vmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{vmatrix}$$

$$3). \begin{vmatrix} 1 & 2 & 3 & 4 \\ 1 & 4 & 9 & 16 \\ 1 & 8 & 27 & 64 \\ 1 & 16 & 81 & 256 \end{vmatrix} \quad 4). \begin{vmatrix} 35 & 59 & 71 & 52 \\ 42 & 70 & 77 & 54 \\ 43 & 68 & 72 & 52 \\ 29 & 49 & 65 & 50 \end{vmatrix}$$

6. Uchburchak ko'rinishiga keltirib hisoblang

$$1). \begin{vmatrix} 1 & 2 & 3 & \dots & n \\ -1 & 0 & 3 & \dots & n \\ -1 & -2 & 0 & \dots & n \\ \dots & \dots & \dots & \dots & \dots \\ -1 & -2 & -3 & \dots & 0 \end{vmatrix} \quad 2). \begin{vmatrix} 1 & 2 & 2 & \dots & 2 \\ 2 & 2 & 2 & \dots & 2 \\ 2 & 2 & 3 & \dots & 2 \\ \dots & \dots & \dots & \dots & \dots \\ 2 & 2 & 2 & \dots & n \end{vmatrix} \quad 3).$$

$$\begin{vmatrix} 0 & 1 & 1 & \dots & 1 \\ 1 & 0 & 1 & \dots & 1 \\ 1 & 1 & 0 & \dots & 1 \\ \dots & \dots & \dots & \dots & \dots \\ 1 & 1 & 1 & \dots & 0 \end{vmatrix} \quad 4). \begin{vmatrix} n & 1 & 1 & \dots & 1 \\ 1 & n & 1 & \dots & 1 \\ 1 & 1 & n & \dots & 1 \\ \dots & \dots & \dots & \dots & \dots \\ 1 & 1 & 1 & \dots & n \end{vmatrix}$$

7. $A = \begin{pmatrix} 3 & -2 \\ 5 & -4 \end{pmatrix}$, $B = \begin{pmatrix} 3 & 4 \\ 2 & 5 \end{pmatrix}$, $C = \begin{pmatrix} 4 & 2 \\ 7 & -1 \end{pmatrix}$ bo'lsa, $A \cdot B - 2C$ ni hisoblang.

8. $A = \begin{pmatrix} 1 & i \\ 1 & -i \end{pmatrix}$, $B = \begin{pmatrix} i & 1 \\ -i & 1 \end{pmatrix}$ bo'lsa, $(i+1) \cdot A + (i-1) \cdot B$ ni hisoblang.

9. Hisoblang.

1) $\begin{pmatrix} 1 & -2 \\ 3 & -4 \end{pmatrix}^2$, 2) $\begin{pmatrix} 1 & a \\ 0 & 1 \end{pmatrix}^n$, 3) $\begin{pmatrix} \lambda & 1 \\ 0 & \lambda \end{pmatrix}^n$, 4) $\begin{pmatrix} 2 & -1 \\ 3 & -2 \end{pmatrix}^n$, 5) $\begin{pmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{pmatrix}^n$

10. Kvadrati no'1 matritsa bo'lgan barcha kvadrat matritsalarini toping.

11. Kvadrati birlik matritsa bo'lgan barcha kvadrat matritsalarini toping.

12. Quyidagi matritsalariga teskari matritsani toping.

1) $\begin{pmatrix} 2 & 4 \\ 1 & 3 \end{pmatrix}$ 2) $\begin{pmatrix} 1 & 2 & -3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix}$ 3) $\begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{pmatrix}$

13. Matritsaviy tenglamalarni yeching.

1) $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \cdot x = \begin{pmatrix} 3 & 5 \\ 5 & 9 \end{pmatrix}$ 2) $x \cdot \begin{pmatrix} 3 & -2 \\ 5 & -4 \end{pmatrix} = \begin{pmatrix} -1 & 2 \\ -5 & 6 \end{pmatrix}$ 3) $\begin{pmatrix} 2 & 1 \\ 3 & 2 \end{pmatrix} \cdot x \cdot \begin{pmatrix} -3 & 2 \\ 5 & -3 \end{pmatrix} = \begin{pmatrix} -2 & 4 \\ 3 & -1 \end{pmatrix}$

1) $\begin{pmatrix} 1 & 2 & -3 \\ 3 & 2 & -4 \\ 2 & -1 & 0 \end{pmatrix} \cdot x = \begin{pmatrix} 1 & -3 & 0 \\ 10 & 2 & 7 \\ 10 & 7 & 8 \end{pmatrix}$

14. Matritsa rangini hisoblang.

1) $\begin{pmatrix} 0 & 4 & 10 & 1 \\ 4 & 8 & 18 & 7 \\ 10 & 18 & 40 & 17 \\ 1 & 7 & 17 & 3 \end{pmatrix}$ 2) $\begin{pmatrix} 1 & -1 & 2 & 3 & 4 \\ 2 & 1 & -1 & 2 & 0 \\ -1 & 2 & 1 & 1 & 3 \\ 1 & 5 & -8 & -5 & -12 \\ 3 & -7 & 8 & 9 & 13 \end{pmatrix}$

15. Tenglamalar sistemalarini 1) Kramer formulasi 2) Matritsaviy 3) Gauss usullarida yeching.

1) $\begin{cases} 3x + 2y = 7 \\ 4x - 5y = 40 \end{cases}$ 2) $\begin{cases} 5x + 2y = 4 \\ 7x + 4y = 8 \end{cases}$ 3) $\begin{cases} x_1 + x_2 + 2x_3 = -1 \\ 2x_1 - x_2 + 2x_3 = -4 \\ 4x_1 + x_2 + 4x_3 = -2 \end{cases}$

$$4) \begin{cases} x_1 + 2x_2 + 4x_3 = 31 \\ 5x_1 + x_2 + 2x_3 = 29 \\ 3x_1 - x_2 + x_3 = 10 \end{cases} 5)$$

$$\begin{cases} x_1 + 2x_2 + 3x_3 - 2x_4 = 6 \\ 2x_1 - x_2 - 2x_3 - 3x_4 = 8 \\ 3x_1 + 2x_2 - x_3 + 2x_4 = 4 \\ 2x_1 - 3x_2 + 2x_3 + x_4 = -8 \end{cases} 6) \begin{cases} x_1 + 2x_2 + 3x_3 + 4x_4 = 5 \\ 2x_1 + x_2 + 2x_3 + 3x_4 = 1 \\ 3x_1 + 2x_2 + x_3 + 2x_4 = 1 \\ 4x_1 + 3x_2 + 2x_3 + x_4 = -5 \end{cases}$$

$$7) \begin{cases} \lambda x + y + z = 1 \\ x + \lambda y + z = \lambda \\ x + y + \lambda z = \lambda^2 \end{cases} 8) \begin{cases} x + ay + a^2z = a^3 \\ x + by + b^2z = b^3 \\ x + cy + c^2z = c^3 \end{cases} 9) \begin{cases} ax + by + z = 1 \\ x + aby + z = b \\ x + by + az = 1 \end{cases}$$

16. Bir jinsli tenglamalar sistemasini yeching:

$$1) \begin{cases} x_1 + 2x_2 + 3x_3 + 4x_4 = 0 \\ x_1 + x_2 + 2x_3 + 3x_4 = 0 \\ x_1 + 5x_2 + x_3 + 2x_4 = 0 \\ x_1 + 5x_2 + 5x_3 + 2x_4 = 0 \end{cases} 2) \begin{cases} x_1 + x_2 + x_3 + x_4 = 0 \\ x_2 + x_3 + x_4 + x_5 = 0 \\ x_1 + 2x_2 + 3x_3 = 0 \\ x_2 + 2x_3 + 3x_4 = 0 \\ x_3 + 2x_4 + 3x_5 = 0 \end{cases}$$

Oliy algebra elementlariga doir joriy nazorat uchun uy vazifalari.

$$I. z = \frac{1}{(-1)^N + \sqrt{(3)^k \cdot i}} \text{ kompleks son berilgan, bunda } k = \begin{cases} 1, \text{ agar } n = 3k - 2 \\ 0, \text{ agar } n = 3k - 1 \\ -1, \text{ agar } n = 3k \end{cases}$$

a) z ni algebraik formada yozing va z^2 ni hisoblang.

b) z ni tirgonometrik formada yozing va z^{N+20} , $\sqrt[4]{z}$ larni hisoblang.

c) z ni ko'rsatkichli formada yozing.

2. $x^3 + Nx + 1 = 0$ tenglama yechimlari x_1, x_2, x_3 bo'lsa, quyidagilarni hisoblang

$$1) x_1^2 + x_2^2 + x_3^2; \quad 2) x_1^2 x_2 + x_1 x_2^2 + x_2^2 x_3 + x_2 x_3^2 + x_3^2 x_1 + x_3 x_1^2;$$

$$3) x_1^4 x_2^2 + x_1^2 \cdot x_2^4 + x_2^4 x_3^2 + x_2^2 x_3^4 + x_3^4 x_1^2 + x_3^2 \cdot x_1^4$$

$$4) \frac{x_1^2}{(x_1+1)^2} + \frac{x_2^2}{(x_2+1)^2} + \frac{x_3^2}{(x_3+1)^2}$$

3. Ferrari usuli bilan yeching;

$$x^4 - x^3 + \left(4 - \frac{N}{2} - \frac{N^2}{4}\right)x^2 + 2Nx + \left(\frac{N^2}{16} - 1\right) = 0,$$

yordamchi kubik tenglama bitta yechimi $-\frac{N}{4}$

4. Gerner sxemasi yordamida

$$P_6(x) = x^6 + (1 - N)x^5 - Nx^4 - x^2 + (N - 1)x + N \text{ va}$$

$P_4(x) = x^4 - (N + 1)x^3 + (N + x)x^2 - (N + 1)x + N$ ko'phadlar EKUB va EKUK lari topilsin.

5. $\frac{x+N}{x^5+2x^4+(N-1)x^3+2(N-1)x^2-Nx-2N}$ kasrni sodda kasrlarga yoying.

6. Nollari ko'p qator elementlari bo'yicha yoyib hisoblang.

$$\begin{vmatrix} 1 & 2 & 3 & -5 \\ 2 & 0 & -1 & 0 \\ 3 & 0 & 2 & N \\ 4 & 0 & 5 & 0 \end{vmatrix}$$

$$7. \begin{cases} x_1 - Nx_2 - x_3 - x_4 = 3 \\ x_1 + x_2 + Nx_3 + 2x_4 = 0 \\ 2x_1 + Nx_2 + x_3 + x_4 = 0 \\ N \cdot x_1 - 3x_2 + 2x_3 - x_4 = -1 \end{cases}$$

sistemani 1) Kramer qoidasi, 2)Matritsaviy,

3) Gauss usuli da yeching.