# SOLVING A SYSTEM OF SOME NON-STANDARD EQUATIONS THAT ARE NOT LINE

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**Annotation.**

The article provides recommendations and guidelines for solving some non-linear systems of nonlinear equations that help to expand and develop students 'thinking.

**Keywords:**

System, system of nonlinear equations, system of nonstandard equations, solution of system, solution of system of equations

Bizga ma'lumki tenglamalar sistemasini yechish teng kuchli sistemalarga yoki natijalarga o'tish qoidalariga asoslanadi. Tenglamalar sistemasini yechishda turli usullar qo'llaniladi. Ko'paytuvchilarga ajratish, o'zgaruvchilarni yo'qotish, algebraik qo'shish, o'zgaruvchilarni almashtirish va shu kabilar , ba'zan maxsus usullardan foydalanishga to'g'ri keladi [1,2,3,4].

Ushbu maqolada ayrim chiziqli bo'lmagan va nostandart tenglamalar sestemasini algebraik usulda yechishga doir ko'rsatmalar berilgan.

**1-masala.** Ushbu tenglamalar sestemasini yeching. $\begin{cases} 4x+5y=x^2 \\ 5x+4y=y^2 \end{cases}$ (1)

*Yechish.* Sistemaning birinchi tenglamasidan $y=\dfrac{x^2-4x}{5}$ ni ifodalab ikkinchi tenglamaga qo'ysak,

$$5x+\frac{4x^2-16x}{5}=\frac{1}{25}x^2\left(x-4\right)^2$$
$$125x+20x^2-80x=x^4-8x^3+16x^2$$
$$x^4-8x^3-4x^2-45x=0$$
$$x\left(x^3-8x^2-4x-45\right)=0$$
$$x\left(x-9\right)\left(x^2+x+5\right)=0$$

$x_1=0, x_2=9$ ni topamiz. Bundan $x_1, x_2$ qiymatlarni $y=\dfrac{x^2-4x}{5}$ ifodaga qo'ysak, $y_1=0, y_2=9$ kelib chiqadi .Demak, berilgan sistema ikkita ildizga ega ekan.

Javob: $(0;0),(9;9)$.

**2-masala.** Ushbu tenglamalar sistemasini yeching. $\begin{cases} x^{\sqrt[4]{x}+\sqrt{y}}=y^{\frac{8}{3}} \\ y^{\sqrt[4]{x}+\sqrt{y}}=x^{\frac{2}{3}} \end{cases}$ (2)

*Yechish.* Ushbu tenglamalar sistemasidagi ikkala tenglamani ham 10 asos bo'yicha logarifmlaymiz:

$$\begin{cases} (\sqrt[4]{x}+\sqrt{y})\lg x=\frac{8}{3}\lg y \\ (\sqrt[4]{x}+\sqrt{y})\lg y=\frac{2}{3}\lg x \end{cases} \quad (3)$$

Endi, ikkala tenglamani birni ikkinchisiga bo'lib, $\frac{\lg x}{\lg y}=\frac{4\lg y}{\lg x}$ tenglamaga ega bo'lamiz, bu quyidagiga teng kuchli $\lg^2 x-4\lg^2 y=0$. Bundan $(\lg x-2\lg y)(\lg x+2\lg y)=0$. Oxirgi tenglamadagi har bir ko'paytuvchini nolga tenglasak,

1) $\lg x=2\lg y \;\Rightarrow\; x=\frac{1}{y^2}$ . $x$ ning bu ifodasini (3) sistemaning 1-tenglamasiga qo'yish orqali

$2\sqrt{y}\cdot 2\lg y=\frac{8}{3}\lg y \Rightarrow \lg y=0, y=1, x=1$ va $\sqrt{y}=\frac{2}{3}, y=\frac{4}{9}, x=\frac{16}{81}$

yechimlarni topamiz.

2) $\lg x=-2\lg y \;\Rightarrow\; x=\frac{1}{y^2}$. $x$ ning bu ifodasini (3) sistemaning 1-tenglamasiga qo'ysak,

$\left(\frac{1}{\sqrt{y}}+\sqrt{y}\right)\cdot(-2\lg y)=\frac{8}{3}\lg y \;\Rightarrow\; \frac{1}{\sqrt{y}}+\sqrt{y}=-\frac{4}{3}$ bu tenglama yechimga ega emas.

Javob $(1;1)$ va $\left(\frac{16}{81};\frac{4}{9}\right)$.

**3-masala.** Tenglamalar sistemasini yeching $\begin{cases} x+y-xy=1 \\ x^2+y^2-xy=3 \end{cases}$ (4)

*Yechish.* [4].Berilgan sistemaning ikkinchi tenglamasini $(x+y)^2-3xy=3$ ko'rinishda yozib olamiz va yangi o'zgaruvchilarni kiritamiz $x+y=u, xy=v$. Natijada ushbu

$$\begin{cases} u-v=1 \\ u^2-3v=3 \end{cases} \qquad (5)$$

Sistemaga ega bo'lamiz. Bu (5) sistemani yechib, $u_1=3, u_2=0, v_1=2, v_2=-1$ ni topamiz. Bularni kiritilgan belgilashlarga qo'ysak, quyidagi 2 ta tenglamalar sistemasini hosil qilamiz:

$$\begin{cases} x+y=3 \\ xy=2 \end{cases} \quad (6) \qquad \text{va} \qquad \begin{cases} x+y=0 \\ xy=-1 \end{cases} \quad (7)$$

(6) sistema yechimlari $(1;2)$ va $(2;1)$ , (7) sistema yechimlari $(1;-1)$ va $(-1;1)$ ekanligi ravshan.

Javob $(1;2)$ , $(2;1)$ , $(1;-1)$ , $(-1;1)$.

**4-masala.** Agar $a$ soning butun qismi $[a]$ va $a$ soning kasr qismi $\{a\}$, $\{a\}=a-[a]$ bo'lsa, quydagi tenglamalar sistemasini yeching.

$$\begin{cases} x+[y]+\{z\}=200,2 \\ \{x\}+y+[z]=200,1 \\ [x]+\{y\}+z=200 \end{cases} \qquad (8)$$

*Yechish.* Berilgan tenglamalar sistemasidagi ikkinchi va uchinchi tenglamalarni qo'shib quydagi tenglamaga ega bo'lamiz:

$x+[y]+\{z\}+2\{y\}+2[z]=400,1$. (8)-sistemadagi birinchi tenglama $x+[y]+\{z\}=200,2$ ekanligini etiborga olsak, $200,2+2\{y\}+2[z]=400,1$ ga ega bo'lamiz, natijada $\{y\}+[z]=99,95$ tenglik hosil bo'ladi. Bundan $[z]=99$, $\{y\}=0,95$ larni topamiz va bu qiymatlarni berilgan sistemadagi 3-tenglamaga qo'yamiz:

$[x]+0,95+99+\{z\}=200$ (bu yerda $z=[z]+\{z\}$),

$[x]+\{z\}=100,05$ bundan $[x]=100$, $\{z\}=0,05$ ekanligi kelib chiqadi.

Endi (8)-sistemadagi 1-tenglamani $[x]=100$, $\{z\}=0,05$ lardan foydalanib quyidagi $100+\{x\}+[y]+0,05=200,2$ ko'rinishda yozib olamiz, oxirgi tenglamani yechib,

$$\{x\}+[y]=100,15,$$

$[y]=100$, $\{x\}=0,15$ qiymatlarga ega bo'lamiz.

Javob. $x=100,15$, $y=100,95$, $z=99,05$.

**5-masala.** Ushbu tenglamalar sistemasini butun yechimlarini toping.

$$\begin{cases} x^3-4x^2-16x+60=y \\ y^3-4y^2-16y+60=z \\ z^3-4z^2-16z+60=x \end{cases} \qquad (9)$$

*Yechish.* Berilgan sistemadagi tenglamalarni qo'shsak, natijasida ushbu

$$x^3-4x^2-17x+60+y^3-4y^2-17y+60+z^3-4z^2-17z+60=0 \text{ yoki}$$

$$(x^3-4x^2-17x+60)+(y^3-4y^2-17y+60)+(z^3-4z^2-17z+60)=0$$ tenglama hosil bo'ladi.

Bu tenglamani yechish uchun har bir qavsdagi ifodani nolga tenglash yetarlidir:

$$x^3-4x^2-17x+60=0, \quad y^3-4y^2-17y+60=0, \quad z^3-4z^2-17z+60=0$$

$$(x-5)(x+4)(x-3)=0; \quad (y-5)(y+4)(y-3)=0; \quad (z-5)(z+4)(z-3)=0;$$

$x_1=5$ $y_1=5$ $z_1=5$

$x_2=-4$ ; $y_2=-4$; $z_2=-4$;

$x_3=3.$ $y_3=3.$ $z_3=3.$

Demak, berilgan tenglamalar sistemasi uchta ildizga ega ekan.

Javob: $(5;5;5)$, $(-4;-4;-4)$, $(3;3;3)$ .

**Adabiyotlar:**

1. Гадаев, Р. Р., Джонизоков, У. А., & Ахадова, К. С. К. (2020). ОПРЕДЕЛИТЕЛЬ ФРЕДГОЛЬМА ДВУМЕРНОЙ ОБОБЩЕННОЙ МОДЕЛИ ФРИДРИХСА. *Наука и образование сегодня*, (12 (59)).
2. Alimov, B., Polatov, B. S., Fayzullayev, A. N. O., & Qongirov, M. N. O. (2021). MATEMATIKADA UCHINCHI SHAXS YUMORI. *Academic research in educational sciences*, *2*(1).
3. Останов, К., Тураев, У. Я., & Рахимов, Б. Ш. (2019). ИЗУЧЕНИЕ ПОНЯТИЯ «СЛУЧАЙНАЯ ВЕЛИЧИНА» И ЗАКОНЫ ЕЕ РАСПРЕДЕЛЕНИЯ. *ББК 72 С127*.
4. Останов, К., Тураев, У., & Рахимов, Б. (2018). Об использовании нестандартных и исследовательских геометрических задач на уроках математики. In *СОВРЕМЕННЫЕ ТЕНДЕНЦИИ РАЗВИТИЯ НАУКИ И ОБРАЗОВАНИЯ* (pp. 541-544).