DIOPHANTE'S SPECIAL CASE EQUATION

Zulhumor Amatovna Tangirova
Academic Lyceum of Tashkent Institute of Architecture and Construction

ABSTRACT

Diophantine equations - algebraic equations with two or more unknowns, whose coefficients are integers; in which solutions consisting of whole or rational numbers are sought. The general theory of the first-order D. t. was created by the French mathematician Bashe, who lived in the 17th century. As a result of research by Fermat, Euler, Lagrange and Gauss at the beginning of the 19th century, the second order D. t. was mainly investigated. The methods of checking D. t. are based on the theory of continuous fractions. D. t. also means systems of algebraic equations with integer coefficients in which the number of unknowns is greater than the number of equations. D. t., sometimes referred to as indeterminate equations.

Keywords: Diophantus, equation, methods, unknown

DIOFANT XUSUSIY HOLDAGI TENGLAMASI

Zulxumor Amatovna Tangirova
Toshkent arxitekura-qurilish instituti akademik litseyi

ANNOTATSIYA

Diofant tenglamalari - ikki yoki undan ko‘p noma’lum qatnashgan, koeffitsiyentlari butun sonlar bo‘lgan algebraik tenglamalar; bunda butun yoki ratsional sonlardan iborat yechimlari izlanadi. Birinchi darajali D. t.ning umumiy nazariyasini 17-asrda yashagan fransuz matematigi Bashe yaratgan. Ferma, Eyler, Lagranj va Gauss tadqiqotlari natijasida 19-asr boshlarida ikkinchi darajali D. t. asosan tekshirilgan edi. D. t.ni tekshirish usullari uzluksiz kasrlar nazariyasiga asoslangan. D. t. deganda noma’lumlari soni tenglamalari sonidan ko‘p bulgan butun koeffitsiyentli algebraik tenglamalar sistemalari ham tushuniladi. D. t., ba’zan, aniqmas tenglamalar deb yuritiladi.

Kalit so’zlar: diofant, tenglama, metodlar, noma’lumlar

Bizga $x^2-2y^2=1$ tenglama berilgan bo’lsin.Va yechim ratsional sonlarda deyilgan talab qo’yilsin.Avvalombor bu tenglamani yechishdan oldin toq sonlar ko’paytmasi toq bo’lishi va juft songa toq sonni yig’indisi doim toq bo’lishini aytib o’tamiz.Toqga toqni ko’paytirsak toq bo’lishini sodda usul bilan ko’rsatib o’tamiz.

Bizga $2n_1+1$ va $2n_2+1$ toq sonlar berilgan bo’lsin ularning ko’paytmasi toq bo’ladi va ifoda $2k+1$ ko’rinishiga keladi bu esa bilamiz toq sonning formulasi.

$2n_1$ juft va $2n_2+1$ toq sonlar berilgan va ularning yig’indisi doim toq bo’lishini isbotlaymiz. Qo’shsak $2(n_1+n_2)+1$ ifodani hosil qilamiz bu esa toq sonning formulasi.

Yuqoridagi tenglamamiz $x^2-2y^2=1$ holatda ayirmasi birga teng sonlar ekan.

Ko'rinib turibdiki y^2 ifoda qandaydir son. Oldidagi ikki bu sonni juftga aylantirib yuboradi. Faqatgina toq sondan juft sonni ayirsagina bir hosil bo'ladi.

Agar $x=\frac{m_1}{n_1}$ desak y ni esa $y=\frac{m_2}{n_2}$ desak va bundan $m_1=2k_1-1$ va $m_2=2k_2$ desak va bularni tenglamaga olib borib qo'ysak quyidagi ifodani olishimiz mumkin. $(2k_1-1)^2 n_2^2 = n_1^2(n_2^2+8k_2^2)$ englikni hosil qilamiz.Birinchi ifodamiz toq son bo'lishi aniq sababi toq sonning kvadrati doim toq bo'ladi.

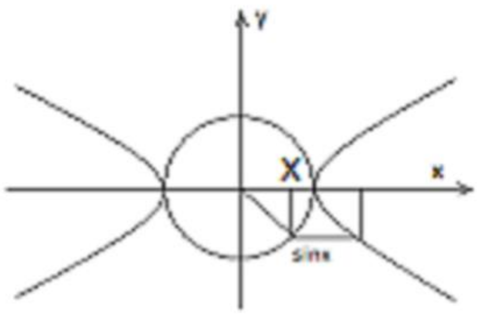
$8k^2$ ifoda doim juft bo'ladi. Qolgan sonlarni ixtiyoriy tanlash mumkin keling birinchi holatni ko'rib chiqamiz n_2 toq son bo'lsa $n_2^2+8k_2^2$ ifoda doim toq bo'ladi. Demak o'z o'zidan n_1 ham toq bo'lar ekan. Agarda son qo'yib tekshirib ko'rsak aniq bo'lib qoladi. $k_1=5$ $k_2=2$ bo'lsa, $81\text{n}_2^2=n_1^2(\text{n}_2^2+32)$ ifodaga ega bo'lamiz 81 bilan qavs ichidagi ifodani tenglashtirsak $n_1=n_2$ tengligi kelib chiqadi. n_2^2 ifoda bilan qavs ichini tenglasak k_2 nolga tengligi kelib chiqadi bunday bo'lishi mumkin emas.

Demak, $n_1=n_2$ tengligi o'z o'zidan kelib chiqadi. Demak qidirayotgan ratsional sonlar maxrajlari bir xilligini bilib oldik. Demak shu qadamdan keyin $n_2=7$ ga tengligi kelib chiqdi. Bundan xulosa shuki x ning birinchi ratsional ildizi $x=9/7$ bundan $y=4/7$ ligi kelib chiqadi. Shu usulni davom ettirib quyidagi natijalarni olishimiz mumkin.

$$\left(\frac{9}{7}\right)^2-2\left(\frac{4}{7}\right)^2=1;\quad \left(\frac{11}{7}\right)^2-2\left(\frac{6}{7}\right)^2;=1;\quad \left(\frac{27}{23}\right)^2-2\left(\frac{10}{23}\right)^2=1;$$

Va hokazo shular kabi yana turlicha ratsional ildizlarni topishimiz mumkin.

Qiymatlardan ko'rinib turibdiki y ninig hamma qiymatlari birdan kichkina qiymatlar ekan. $x^2-2y^2=1$ funksiya bu giperbola tenglamasi ekan. y ning eng kichik qiymati 0 ga tengligini hisobga olsak x ning eng kichik qiymati 1 ga tengligini ko'ramiz. Agarda uning grafigi bilan birlik aylanadagi $\sin(x)$ va $\cos(x)$ bilan bitta koordinatalar tekisligiga yozsak quyidagi grafikga ega bo'lamiz.



Bu holat faqatgina ratsional ildizlarni qidirganimiz yuzaga keldi.

Grafikdan ko'rinib turibdiki $\sin(x)$ ning qiymati $y_{\sin(x)}$ bilan giperbolani qiymatlari xar xil x larda bir xil qiymatga ega bo'lar ekan.

$y_{\sin(x)} = y_{giperbola}$ lekin $x_{\sin(x)} \neq x_{giperbola}$ bundan quyidagi tenglikni yozsak bo'lar ekan. $x^2 - 2\sin^2\left(x_{\sin(x)}\right) = 1$ bundan $x \in [0;1]$ oraliqda cheksiz ko'p ratsional ildizni topish mumkin. y ning qiymatlari quyidagilar bo'lishi mumkin, ya'ni birdan kichikina sonlar.

Ba'zi ko'p no'malumli tenglamalarni yechish usullari haqida

Ushbu maqolada $a^x + a^2 = y^2$, $A(x) = B(x)$ va $\sqrt{p\sqrt{q} - q} = \sqrt{x\sqrt{q}} - \sqrt{y}\sqrt{q}$

Ko'rinishidagi tenglamalar ko'riladi. Bu tenglamalarni natural, butun va ratsional sonlar to'plamidagi yechimlarni topish kerak bo'ladi.

1. $a^x + a^2 = y^2$ $(a \geq 1,\ a - natural\ son)$ tenglamani butun sonlarda yechamiz. Bu ko'rinishdagi yechish uchun $a^x = (y-a)(y+a)$ ko'rinishiga keltirib olamiz. Bulardan $y-a$ va $y+a$ lar $a^x -$ ning bo'luvchilari bo'lishligi kelib chiqadi. $y - a = a^p$, $y + a = a^q$ bu yerda $p,\ q \in Z,\ p < q$. Shuning uchun $a^q - a^p = (y+a) - (y-a) = 2a$ $a^p\left(a^{q-p} - 1\right) = 2a$ yoki $a^{p-1}\left(a^{q-p} - 1\right) = 2$

Demak, $a^{p-1} = 2$ yoki $a^{q-p} - 1 = 2$ ekan. Bundan a ning 2 ga yoki 3 ga teng bo'lishi kerakligi hosil bo'ladi. $a = 2$ bo'lsa, tenglama $2^x + 4 = y^2$ ko'rinishiga keladi. Bu tenglamani natural sonlarda yechaylik.

$$2^x(y-2)(y+2)\,y - 2 = 2^p,\quad y + 2 = 2^q\ 2^q - 2^p = 4,\quad 2p\left(2^{q-p} - 1\right) = 4,$$

$$2^{p-1}\left(2^{q-p} - 1\right) = 4,\quad 2^{p-1}\left(2^{q-p} - 1\right) = 2,\quad p - 1 = 1,\quad p = 2 \rightarrow q = 3$$

$2x = 2^p 2^q$, $x = 5 \rightarrow y = 6$, $a = 3$ bo'lsa, tenglama $3^x + 9 = y^2$ ko'rinishga keladi. Bu tenglamani natural sonlarda yechaylik .

$$3x = (y-3)(y+3)\,y - 3 = 3^p,\quad y + 3 = 3^q$$

$$3^a - 3^p = 6,\quad 3^p\left(3^{q-p} - 1\right) = 6,\quad 3^{p-1}\left(3^{q-p} - 1\right) = 2,\quad p - 1 = 0,\quad \rightarrow q = 2$$

$$3^x = 3^q 3^p,\quad x = 3 \rightarrow y = 6.$$

REFERENCES

1. Quromboyev, H. (2022). Nostandart olimpiada masalalarini yechish usullari haqida. *Академические исследования в современной науке*, *1*(13), 231-233.
2. Қуромбоев, Ҳ. (2022). I тип зигел соҳаси учун карлеман формуласи. *Models and methods in modern science*, *1*(13), 52-56.
3. Куромбоев, Х. Н. (2019). МАТЕМАТИЧЕСКАЯ НАУКА К ПОВСЕДНЕВНОЙ ЖИЗНИ. *Экономика и социум*, (2), 619-621.
4. Куромбоев, Х. Н. (2020). О ФОРМУЛЕ КАРЛЕМАНА. *Мировая наука*, (5), 278-282.
5. Kuromboev, K. N., Allanazarov, K., & Shokirov, J. (2019). INDIVIDUAL ABILITIES OF STUDENTS IN TEACHING MATHEMATICS. *Экономика и социум*, (2), 622-625.
6. Ruzmetova, S. T. K. (2022). DEVELOPING TEACHING SPEAKING IN A FOREIGN LANGUAGE TO YOUNG LEARNERS THROUGH INTERACTIVE METHODS. *Academic research in educational sciences*, *3*(3), 651-656.

7. Rahimova, H. Q., Bobojonova, M. R., & Ruzmetova, S. T. (2016). METHODS OF TEACHING VOCABULARY BY USING SHORT STORIES IN CLASS. *Проблемы и перспективы современной науки*, (12), 103-106.
8. Kuromboev, K. N. (2019). HISTORY AND APPLICATION OF THE MATRIX. *Экономика и социум*, (2), 615-618.
9. Usmonov, B. Z., & Qobilov, T. A. (2021). Isbotlashlarda taqqoslamalar ning o'rni. *Academic research in educational sciences*, *2*(5), 2181-1385.
10. Kutlimurotov, R. A., Usmonov, B. Z., Toshbayeva, N. Y. L., & Eshqorayev, Q. (2021). CHEKLI ZANJIRLI KASRLARNI BAZI MASALALARGA TADBIQI. *Academic research in educational sciences*, *2*(5), 914-921.
11. Eshqoraev, Q. (2021). VERBAL INTELLEKT–KASBIY VA IJTIMOIY KOMTETENTLIKNI RIVOJLANTIRISH OMILI SIFATIDA. *Academic research in educational sciences*, *2*(CSPI conference 3), 428-432.
12. Тошбоева, Н. (2021). Развитие творческих способов студентов с помощью нестандартных вопросов. *Academic research in educational sciences*, *2*(NUU Conference 1), 393-395.
13. Кобилов, Т. А. Экстент гиперпространства сходящейся под последовательностей. *MINISTRY OF HIGHER AND SECONDARY SPECIAL EDUCATION OF THE REPUBLIC OF UZBEKISTAN*, 135.
14. Ergashev, I. (2022). QIZIQARLI GEOMETRIK MASALALARNI YECHISHDA KREATIV YONDASHUV. *Models and methods in modern science*, *1*(13), 90-92.
15. Исломов, С. М. d-сепарабельность гиперпространств. In *РЕСПУБЛИКАНСКОЙ НАУЧНОЙ КОНФЕРЕНЦИИ* (p. 154).
16. qizi Rustamova, S. A. (2022, September). INTERFAOL METODLAR ORQALI TALABALAR FAOLLIGINI OSHIRISH. In *INTERNATIONAL CONFERENCES* (Vol. 1, No. 11, pp. 41-46).
17. Abdullayev, S. A., Aktamov, F., & Raupova, M. (2021). "FUNKSIYA XOSILASI" MAVZUSINI O 'RGANISHDA KLASTER MODELIDAN FOYDALANISH METODIKASI. Academic research in educational sciences, 2(CSPI conference 3), 420-424.
18. Qayumov, S., Mardanov, A., Qayumov, A., & Xaitov, T. (2021). Multiparameter mathematical models of the filtration problem of unstructured and structured fluids. In *E3S Web of Conferences* (Vol. 264, p. 01030). EDP Sciences.
19. Каюмов, Ш., Хаитов, Т., Марданов, А., & Бекчанов, Ш. (2022). К математическому моделированию задачи фильтрации ньютоновских и структурированных флюидов в двухслойном среде. *Ренессанс в Парадигме Инноваций Образования и Технологий в XXI Веке*, (1), 287-289.
20. Rustamova, S. A. (2022). MATEMATIKANI O'QITISHDA YANGI PEDAGOGIK TEXNOLOGIYALARNING O'RNI. Uzbek Scholar Journal, 10, 169-173.