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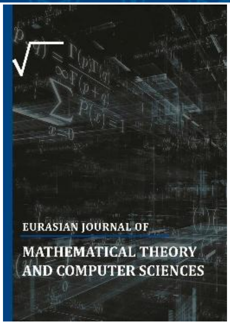

FINDING THE NUMBER OF PYTHAGOREAN PAIRS OF A NATURAL NUMBER THAT ARE NOT COMMON BASES

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ABSTRACT

The following explains that if (a,b;c) is a Pythagorean pair, then the number a is a Pythagorean pair of the number b, and the Pythagorean triples ... , then the Pythagorean pairs for the number a are given. It is also stated that if the number a is a Pythagorean pair of the number b, then the number b is also a Pythagorean pair of the number a. Pythagorean numbers, determining the number of Pythagorean pairs of a Pythagorean number are explained.

NATURAL SONNING O‘ZARO TUB BO‘LMAGAN PIFAGOR JUFTLARI SONINI TOPISH

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ABSTRACT

Quyida (a,b;c) Pifagor juftligi bo‘lsa, u holda a soni b sonining Pifagor jufti bo‘lishi haqida,Pifagor uchliklari $(a, b_1; c_1)$, $(a, b_2; c_2)$, … , $(a, b_n; c_n)$ *berilganda u holda a soni uchun* $b_1, b_2, \dots, b_n$ *Pifagor juftlari haqida ma’lumot berilgan. Shuningdek a soni b sonining Pifagor jufti bo‘lsa, u holda b soni ham a sonining Pifagor jufti ekanligi keltirilgan.Pifagor sonlari, biror Pifagor soning Pifagor juftlari sonini aniqlash yoritilgan.*

Ma’lumki, istalgan $n, m \in \mathbb{N}$, $n > m$ sonlari yordamida hosil qilingan

$$a = n^2 - m^2, \quad b = 2nm, \quad c = n^2 + n^2 \qquad (1)$$

$(a, b; c)$ uchlik Pifagor uchligini bo‘ladi. (1) formula yordamida istalgan Pifagor uchligini hosil qilish mumkin [1]- [5].

Endi bir Pifagor uchligi berilgan bo‘lsa, uning yordamida yangi Pifagor uchligini hosil qilish usulini bayon qilamiz.

2.5- ta'rif . Agar $(a, b; c)$ Pifagor juftligi bo‘lsa, u holda a soni b sonining Pifagor jufti deyiladi.

Bizga Pifagor uchliklari $(a, b_1; c_1), (a, b_2; c_2), \dots, (a, b_n; c_n)$ berilsin, u holda a soni uchun $b_1, b_2, \dots, b_n$ sonlari Pifagor juftlari deb ataladi.

Ta'rifdan kelib chiqadiki, agar a soni b sonining Pifagor jufti bo‘lsa, u holda b soni ham a sonining Pifagor jufti bo‘ladi.

2.1-teorema. $n = 2k, \forall\, k \in N$ juft sonlar Pifagor juftlari (PJS) soni

$$\mathbf{(PJS)\ (2k)} = \frac{\boldsymbol{NBS(k^2) - 1}}{\mathbf{2}}$$

2.2-teorema. Ixtiyoriy $n = 2k + 1$, $\forall\ k \in N$ toq sonning Pifagor juftlari soni $\boldsymbol{PJS(2k+1)} = \frac{\boldsymbol{NBS((2k+1)^2)-1}}{\mathbf{2}}$

$$(2n)^2 + \left(\frac{n^2}{p_i} - p_i\right)^2 = \left(\frac{n^2}{p_i} + p_i\right)^2$$

$\forall\ n, p_i \in Z$ uchun bunday Pifagor juftlarining soni ((p_i – n^2 ning turli bo’luvchilari) $\frac{n^2}{p_i} - p_i$ - $p_i < x$ tengsizligini qanoatlantiruvchi butun sonlar soni. Agar biz ayniyatning ikkala qismini p_i ning kvadratiga ko'paytirsak, u holda biz barcha Pifagor sonlarini beradigan klassik formulani olamiz, ya'ni ular orasida 2n juft sonli barcha Pifagor juftlari bor, ya'ni

$$(2n)^2 + \left(\frac{n^2}{p_i} - p_i\right)^2 = \left(\frac{n^2}{p_i} + p_i\right)^2$$

$$4n^2 + \frac{n^4}{{p_i}^2} - 2n^2 + {p_i}^2 = \frac{n^4}{{p_i}^2} + 2n^2 + {p_i}^2$$

tenglik bajariladi va $2n$ juft soni Pifagor juftlarining soni $\frac{n^2}{p_i} - p_i$sonining butun son yekanligiga bog'liqligidan, u holda $n = 2k$, $\forall\ k \in N$ juft soni Pifagor juftlari

$$(\text{PJS})\ (2k) = \frac{NBS(k^2) - 1}{2}$$

2.1-misol. 72 sonining Pifagor juftlarini topamiz.

Yechish. 1-usul. k=36 bo‘lgani uchun

$$(2.36)^2 + \left(\frac{36^2}{p_i} - p_i\right)^2 = \left(\frac{36^2}{p_i} + p_i\right)^2$$

$$(2.36)^2 + \left(\frac{2^4.3^4}{p_i} - p_i\right)^2 = \left(\frac{2^4.3^4}{p_i} + p_i\right)^2$$

$\frac{2^4.3^4}{p_i}$ kasr butun songa teng bo'lgan shunday $p_i < 36$ni topamiz.

$p_1 = 1,\quad 72^2 + \left(\frac{2^4.3^4}{1} - 1\right)^2 = \left(\frac{2^4.3^4}{1} + 1\right)^2 \qquad 72^2 + 1295^2 = 1297^2$

$p_2 = 2,\quad 72^2 + \left(\frac{2^4.3^4}{2} - 2\right)^2 = \left(\frac{2^4.3^4}{2} + 2\right)^2 \qquad 72^2 + 646^2 = 650^2$

$p_3 = 3,\quad 72^2 + \left(\frac{2^4.3^4}{3} - 3\right)^2 = \left(\frac{2^4.3^4}{3} + 3\right)^2 \qquad 72^2 + 429^2 = 435^2$

$p_4 = 4,\quad 72^2 + \left(\frac{2^4.3^4}{4} - 4\right)^2 = \left(\frac{2^4.3^4}{4} + 4\right)^2 \qquad 72^2 + 320^2 = 328^2$

$p_5 = 6,\quad 72^2 + \left(\frac{2^4.3^4}{6} - 6\right)^2 = \left(\frac{2^4.3^4}{6} + 6\right)^2 \qquad 72^2 + 210^2 = 222^2$

$p_6 = 8, \quad 72^2 + (\frac{2^4.3^4}{8} - 8)^2 = (\frac{2^4.3^4}{8} + 8)^2 \qquad 72^2 + 154^2 = 170^2$

$p_7 = 9, \quad 72^2 + (\frac{2^4.3^4}{9} - 9)^2 = (\frac{2^4.3^4}{9} + 9)^2 \qquad 72^2 + 135^2 = 153^2$

$p_8 = 12, \quad 72^2 + (\frac{2^4.3^4}{12} - 12)^2 = (\frac{2^4.3^4}{12} + 12)^2 \qquad 72^2 + 96^2 = 120^2$

$p_9 = 16, \quad 72^2 + (\frac{2^4.3^4}{16} - 16)^2 = (\frac{2^4.3^4}{16} + 16)^2 \qquad 72^2 + 65^2 = 97^2$

$p_{10} = 18, \quad 72^2 + (\frac{2^4.3^4}{18} - 18)^2 = (\frac{2^4.3^4}{18} + 18)^2 \qquad 72^2 + 54^2 = 90^2$

$p_{11} = 24, \quad 72^2 + (\frac{2^4.3^4}{18} - 18)^2 = (\frac{2^4.3^4}{18} + 18)^2 \qquad 72^2 + 54^2 = 90^2$

$p_{12} = 27, \quad 72^2 + (\frac{2^4.3^4}{27} - 27)^2 = (\frac{2^4.3^4}{27} + 27)^2 \qquad 72^2 + 21^2 = 75^2$

Bundan kelib chiqadiki, biz 72 sonining barcha natural bo'luvchilari sonini topdik. Demak, (PJS) (72)=12.

2-usul. 1-teorema asosida buni ham topish mumkin

$$\text{PJS}(72) = \frac{NBS(36^2) - 1}{2} = 12$$

2-misol. 15 sonining Pifagor juftlarini topamiz.

Yechish. 1-usul.

$p_1 = 1, \quad 15^2 + (\frac{\frac{3^2 \cdot 5^2}{1} - 1}{2})^2 = (\frac{\frac{3^2 \cdot 5^2}{1} + 1}{2})^2 \qquad 15^2 + 112^2 = 113^2$

$p_2 = 3, \quad 15^2 + (\frac{\frac{3^2 \cdot 5^2}{3} - 3}{2})^2 = (\frac{\frac{3^2 \cdot 5^2}{3} + 3}{2})^2 \qquad 15^2 + 35^2 = 38^2$

$p_3 = 5, \quad 15^2 + (\frac{\frac{3^2 \cdot 5^2}{5} - 5}{2})^2 = (\frac{\frac{3^2 \cdot 5^2}{5} + 5}{2})^2 \qquad 15^2 + 20^2 = 25^2$

$p_3 = 9, \quad 15^2 + (\frac{\frac{3^2 \cdot 5^2}{9} - 9}{2})^2 = (\frac{\frac{3^2 \cdot 5^2}{9} + 9}{2})^2 \qquad 15^2 + 8^2 = 17^2$

2-usul. 2-teoremadan foydalanib, topamiz

$$\text{PJS}(15) = \frac{NBS((2k+1)^2) - 1}{2} = 4$$

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