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Research Article

ON THE NONIC DIOPHANTINE EQUATION WITH THREE UNKNOWNS 8x^2+8y^2-15xy=32z^9

D.Geetha*

Saranathan College of Engineering, Trichirappalli, Tamilnadu, India

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ABSTRACT

We obtain two different patterns of non-zero integral solutions of the Nonic diophantine equation with three unknowns 8x^2+8y^2-15xy=32z^9 by employing suitable transformations.

INTRODUCTION

Diophantine equations, homogeneous and non- homogeneous have aroused the interest of numerous mathematicians since antiquity as can be seen from [1-2]. The problem of finding all integral solutions of on Interminate equation with three or more variables in general presents a good deal of difficulties. Particularly in [5,6] special equations of sixth degree with four and five unknowns are studied. In [7,8] heptic equations with three and five unknowns are analysed . In this communication a nonic Polynomial equation with three variables represented by $\mathbf{8x^2+8y^2-15xy=3\,2z^9}$ is considered and two different patterns of non-zero integral solutions have been presented.

Method of Analysis

The equation under consideration is

$$8x^2+8y^2-15xy=32z^9 \quad (1)$$

Assigning the transformations

x=u+v,y=u–v (2)

in (1) leads to

$$u^2+31v^2=32z^9 \quad (3)$$

The above equation (3) is solved through different approaches and thus, one obtains different sets of solutions to (1)

Case 1

Assumethat$z=a^2+31b^2$ (4)

Write**3 2**= $\frac{(n+ni\sqrt{3\,1})(n-ni\sqrt{3\,1})}{n^2}$**n=1,2,3,………….** **(5)**

use (5) & (4) in (3) and applying the method of factorization, define

$$u+i\sqrt{31}v=\frac{1}{n}\left(n+in\sqrt{31}\right)\left(a+ib\sqrt{31}\right)^9$$

Equating the real and imaginary parts, we have

$u = u(a,b) = a^9-279a^8b-1116a^7b^2+80724a^6b^3+121086a^5b^4-3753666a^4b^5$

$-2502444a^3b^6+33246756a^2b^7+8311689ab^8-28629151b^9$

$v=v(a,b)=a^9+9a^8b-1116a^7b^2-2604a^6b^3+121086a^5b^4+121086a^4b^5-2502444a^3b^6$
$-1072476a^2b^7+8311689ab^8+923521b^9$

Substituting the above values of u and v in equation (2),and hence the non-zero integral solutions of (1) are

Corresponding author:* **D.Geetha
Saranathan College of Engineering, Trichirappalli, Tamilnadu, India

$x = 2a^9-270a^8b-2232a^7b^2+78120a^6b^3+242172a^5b^4-3632580a^4b^5-5004888a^3b^6+32174280a^2b^7+16623378ab^8-27705630b^9$ (6)

$y=-288a^8b+83328a^6b^3-3874752a^4b^5+34319232a^2b^7-29552672b^9$ (7)

$z = a^2+31b^2$

Case 2

Equation (3) can be written as $\boldsymbol{u^2 + 31v^2 = 32z^9 * 1}$ (8)

Instead of (5), we write as

$$\frac{(2+2i\sqrt{31})(2-2i\sqrt{31})}{4} \quad (9)$$

and also 1 as

$$\frac{(15+i\sqrt{31})(15-i\sqrt{31})}{256} \quad (10)$$

use (4), (10), (9) in (8) and applying the method of factorization, define

$$u + i\sqrt{31}v = \frac{1}{32}\left[\left(a + i\sqrt{31}b\right)^9\left(2 + 2i\sqrt{31}\right)\left(15 + i\sqrt{31}\right)\right] \quad (11)$$

Equating the real and imaginary part, we have

$u = u(a,b) = -a^9-279a8b+1116a^7b^2+80724a^6b^3-121086a^5b^4-3753666a^4b^5+2502444a^3b^6+33246756a^2b^7-8311689ab^8-28629151b^9$

$v = v(a,b) = a^9-9a^8b-1116a^7b^2+2604a^6b^3+121086a^5b^4-121086a^4b^5-2502444a^3b^6+$

$1072476a^2b^7+8311689ab^8-923521b^9$

Substituting the values of u and v in equ (2), then the values of x and y are given by

$x=-288a^8b+83328a^6b^3-3874752a^4b^5+34319232a^2b^7-29552672b^9$

$y=-2a^9-270a^8b+2232a^7b^2+78120a^6b^3-242172a^5b^4-3632580a^4b^5+5004888a^3b^6+32174280a^2b^7-16623378ab^8-27705630b^9$

$z = a^2+31b^2$

CONCLUSION

In this paper we have presented two different patterns of nonzero integral solutions of the Nonic Diophantine equation with three unknown (1). One may search for other patterns of solutions and their corresponding properties.

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