iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** X **Month of publication:** October 2018

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue X, Oct 2018- Available at www.ijraset.com

Remark on the Paper Entitled Lattice Points of a Cubic Diophantine Equation $11(x+y)^2 = 4(xy+11z^3)$

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Abstract: In this paper, new sets of solutions to the cubic equation with three unknowns given by $11(x+y)^2 = 4xy + 44z^3$ ***are presented.***
Keywords: Ternary cubic, Integer solutions

I. INTRODUCTION

When a search is made for cubic diophantine equations, the authors noticed a paper by Manju Somanath, J. Kannan, K. Raja [1] in which they have presented lattice points of the cubic diophantine equation $11(x+y)^2 = 4xy + 44z^3$. However, there are other interesting sets of solutions to the above equations that are exhibited in this paper.

II. METHOD OF ANALYSIS

Consider the cubic equation with three unknowns given by

$$11(x+y)^2 = 4xy + 44z^3 \tag{1}$$

To start with, the substitution

$$y = (2k-1)x \tag{2}$$

in (1) gives

$$(11k^2 - 2k + 1)x^2 = 11z^3$$

which is satisfied by

$$x = 121(11k^2 - 2k + 1)\alpha^3 \tag{3}$$

$$z = 11(11k^2 - 2k + 1)\alpha^2 \tag{4}$$

Note that (2) – (4) satisfies (1)

Again, the substitution

$$y = 2kx \tag{5}$$

in (1) leads to

$$(44k^2 + 36k + 11)x^2 = 44z^3$$

whose solutions are

$$x = 242(44k^2 + 36k + 11)\alpha^3 \tag{6}$$

$$z = 11(44k^2 + 36k + 11)\alpha^2 \tag{7}$$

Thus, (5)-(7) satisfy (1)

Further,

Introduction of the linear transformations

$$x = u + v, \quad y = u - v, \quad z = u \tag{8}$$

in (1) leads to

$$v^2 = u^2(11u - 10) \tag{9}$$

After performing some algebra, it is noted that (9) is satisfied by the following two choices of u and v:

1) $u = 11k^2 - 2k + 1, v = (11k-1)(11k^2 - 2k + 1)$

2) $u = 11k^2 + 2k + 1, v = (11k+1)(11k^2 + 2k + 1)$

In view of (8), the corresponding two sets of values to x, y, z satisfying (1) are represented below:

a) Set 1: Consider choice (i). The values of x, y, z are:

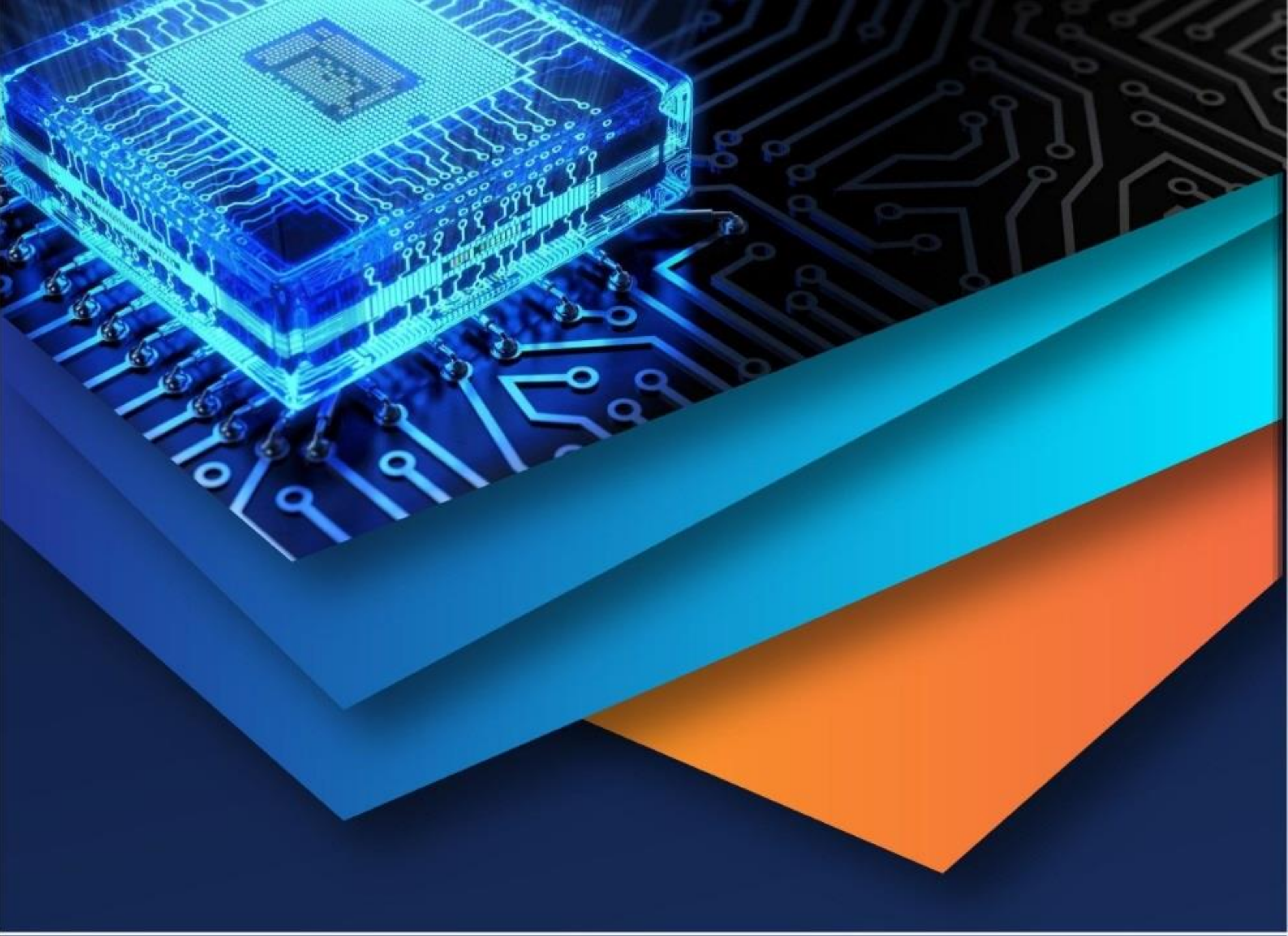
$$x = 11k\left(11k^2 - 2k + 1\right)$$
$$y = (2 - 11k)\left(11k^2 - 2k + 1\right)$$
$$z = 11k^2 - 2k + 1$$

b) Set 2: Consider choice (ii). The values of x, y, z are:

$$x = (11k + 2)\left(11k^2 + 2k + 1\right)$$
$$y = -11k\left(11k^2 + 2k + 1\right)$$
$$z = 11k^2 + 2k + 1$$

REFERENCE

[1] Manju Somanath, J.Kannan, K.Raja, "Lattice Points Of A Cubic Diophantine Equation $11(x+y)^2 = 4\left(xy + 11z^3\right)$", IJRASET, Volume 5, Issue 5,1797-1800, 2017.



10.22214/IJRASET

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