



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: V Month of publication: May 2023

DOI: <https://doi.org/10.22214/ijraset.2023.52661>

www.ijraset.com

Call:  08813907089

E-mail ID: ijraset@gmail.com

A Review on Second Degree Homogeneous Diophantine Equation with Three Unknowns

$$x^2 + y^2 = 122z^2$$

K Hema¹, Ammineni Deepak Teja², Giri Kollati³

¹Assistant Professor, Department of Mathematics, School of Engineering and Technology, Dhanalakshmi Srinivasan University, Trichy, Tamil Nadu, India.

^{2,3}B.Tech Student, Department of Computer Science Engineering, Dhanalakshmi Srinivasan University, Trichy – 621 112, TN, India.

Abstract: The homogeneous ternary second degree equation given by $x^2 + y^2 = 122z^2$ is analysed for its non-zero distinct integral points on that. Completely various patterns of the equation into consideration are obtained by using python.

Keywords: Ternary, quadratic, Integer solutions, Homogeneous, Diophantine, python.

I. INTRODUCTION

It is acknowledge that the quadratic Diophantine equations with 3 unknowns (homogeneous or non-homogeneous) are made in selection [1,2,]. Significantly, one might refer [3-17] for homogeneous or non-homogeneous ternary second degree Diophantine equations that are analysed for getting their corresponding non-zero distinct integer solutions. During this communication, one more attention-grabbing homogeneous ternary quadratic Diophantine equation given by $x^2 + y^2 = 122z^2$ is analysed for its non-zero distinct integer results through fully different strategies with simple python programs. One may gain different values for the input of their programs.

II. STYLES OF ANALYSIS

The ternary second degree equation to be answered for its integer results is

$$x^2 + y^2 = 122z^2 \tag{1}$$

A. Pattern I

Write 122 as

$$122 = (11+i)(11-i) \tag{2}$$

Assume

$$z = a^2 + b^2 \tag{3}$$

Thus we tend to get,

$$x = 11a^2 + 11b^2 + 2aby = a^2 + b^2 + 22ab$$

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

We are going to see this by simple python code as follows:

```
import math
a=int(input("enter the value of a"))
b=int(input("enter the value of b"))
x=(11*a**2)-(11*b**2)-2*a*b;
y=(a**2)-(b**2)+22*a*b;
z=(a**2)+(b**2);
print("the value of x is",x);
print("the value of y is",y);
print("the value of z is",z);
```

output :
 enter the value of a 5
 5
 enter the value of b 5
 5
 the value of x is -50
 the value of y is 550
 the value of z is 50

B. Pattern 2

Equation (1) can also be written as

$$x^2 - y^2 - 121z^2 - z^2$$

$$- x^2 - 121z^2 - z^2 - y^2 \tag{4}$$

Applying the tactic of cross-multiplication to the on-top system of equations, note that

$$x - 11z^2 - 11z^2 - 2z^2$$

$$y - z^2 - z^2 - 22z^2 - z^2 - z^2$$

Applying python codes and considering alpha and beta as a and b we get ,

```
import math
a=int(input("enter the value of a"))
b=int(input("enter the value of b"))
x=(11*a**2)-(11*b**2)+2*a*b;
y=(-a**2)+(b**2)+22*a*b;
z=(a**2)+(b**2);
print("the value of x is",x);
print("the value of y is",y);
print("the value of z is",z);
```

Output :

enter the value of a 5
 5
 enter the value of b 5
 5
 the value of x is 50
 the value of y is 550
 the value of z is 50

C. Pattern III

One can also be written as

$$x^2 - y^2 - 122z^2 - 1$$

Write 1 as

$$1 - 3 - 4i - 3 - 4i - 25 \tag{5}$$

(6)

As our interest is on finding integer solutions replacing a by 5A & b by 5B , we get

$$\left. \begin{aligned} x &= 29A^2 - 29B^2 - 94AB \\ y &= 47A^2 - 47B^2 - 58AB \\ z &= 5A^2 - 5B^2 \end{aligned} \right\} \tag{7}$$

Considering A,B as a,b we are following results:

```
import math
a=int(input("enter the value of a"))
b=int(input("enter the value of b"))
x=(29*a**2)-(29*b**2)-94*a*b;
y=(47*a**2)-(47*b**2)+58*a*b;
z=(5*a**2)+(5*b**2);
print("the value of x is",x);
print("the value of y is",y);
print("the value of z is",z);
```

Output:

```
enter the value of a 5
5
enter the value of b 5
5
the value of x is -2350
the value of y is 1450
the value of z is 250
```

D. Pattern IV

Introduction of the direct metamorphoses

$$x=u+v, y=u-v, z=2w$$

(8)

in (1) leads to

$$u^2 \square v^2 \square 244w^2$$

Assume

$$w \square c^2 \square d^2$$

Thereby we are getting these following results

(10)

(11)

we are getting these following results :

$$x \square 22c^2 \square 22d^2 \square 4cd$$

$$y \square \square 2c^2 \square 2d^2 \square 44cd$$

$$z \square 2c^2 \square 2d^2$$

import math

```
c=int(input("enter the value of c"))
d=int(input("enter the value of d"))
x=(22*c**2)-(22*d**2)-4*c*d;
y=(-2*c**2)+(2*d**2)-44*c*d;
z=(2*c**2)+(2*d**2);
print("the value of x is",x);
print("the value of y is",y);
print("the value of z is",z);
```

Output :

enter the value of c 5

5

enter the value of d 5

5

the value of x is -100

the value of y is -1100

the value of z is 100

III. CONCLUSION

In this paper, an bid has been created to get non-zero distinct integer results to the ternary quadratic Diophantine equation $x^2 + y^2 + z^2 = 122$ representing homogeneous cone with python canons. As there are kinds of cones, the compendiums might rummage around for indispensable kinds of cones to get integer results for the corresponding cones with python codes.

REFERENCES

- [1] L.E. Dickson, History of theory of Numbers, Vol. 2, Chelsea publishing Company, Newyork, 1952.
- [2] Mordel , Diophantine Equations, Academic press, Newyork, 1969.
- [3] Gopalan M.A., Geetha D,Lattice points on the hyperbola of two sheets $x^2 + 6xy + y^2 + 6x + 2y + 5 + z^2 = 4$, Impact J Sci Tech:4:23-32,2010.
- [4] Gopalan M.A., Vidhyalakshmi S,Kavitha A, Integral points on the homogeneous cone Diophantine J Math; 1(2):127-136, 2012. $z^2 + 2x^2 + 7y^2$, The
- [5] Gopalan M.A., Vidhyalakshmi S, Sumathi G,Lattice points on the hyperboloid of one sheet $4z^2 + 2x^2 + 3y^2 + 4$, Diophantine J Math; 1(2): 109-115, 2012.
- [6] Gopalan M.A., Vidhyalakshmi S, Lakshmi K, Integral points on the hyperboloid of two sheets $3y^2 + 7x^2 + z^2 = 21$, Diophantine J Math; 1(2):99-107, 2012.
- [7] Gopalan M.A., Vidhyalakshmi S, Mallika S, Observations on hyperboloid of one sheet JMath; 2(3):221-226,2012. $x^2 + 2y^2 + z^2 = 2$, Bessel
- [8] Gopalan M.A., Vidhyalakshmi S, Usha Rani T.R., Mallika S, Integral points on the homogeneous cone $6z^2 + 3y^2 + 2x^2 = 0$, Impact J Sci Tech; 6(1):7-13, 2012.
- [9] Gopalan M.A., Vidhyalakshmi S, Sumathi G, Lattice points on the elliptic paraboloid Applied Mathematics;7(4): 379-385, 2012. $z + 9x^2 + 4y^2$, Advances in
- [10] Gopalan M.A., Vidhyalakshmi S, Usha Rani T.R., Integral points on the non-homogeneous cone $2z^2 + 4xy + 8x + 4z = 0$, Global Journal of Mathematics and Mathematics sciences 2012;2(1):61-67.
- [11] Gopalan M.A., Vidhyalakshmi S, Lakshmi K, Lattice points on the elliptic paraboloid $16y^2 + 9z^2 + 4x$, Bessel JMath;
- [12] Python Object-Oriented Programming by Steven F.Lott and Dusty Phillips ,4th edition.
- [13] Effective Python by Brett Slatkin , 1st edition



10.22214/IJRASET



45.98



IMPACT FACTOR:
7.129



IMPACT FACTOR:
7.429



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24*7 Support on Whatsapp)