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A Review on Second Degree Homogeneous Diophantine Equation with ThreeUnknowns $x^2+y^2=122z^2$

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***Abstract:** The homogeneous ternary second degree equation given by $x^2+y^2=122z^2$ is analysed for its non-zero distinctintegral 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 $x^2 \square y^2 \square 122z^2$ 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

$$x^2 \square y^2 \square 122z^2 \quad (1)$$

A. *Pattern I*

Write 122 as

$$122=(11+i)(11-i) \quad (2)$$

Assume

$$z \square a^2 \square b^2 \quad (3)$$

Thus we tend to get,

$$x \square 11a^2 \square 11b^2 \square 2aby \square a^2 \square b^2 \square 22ab$$
$$z \square a^2 \square b^2$$

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);
```

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ouput :
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 wriiten as

$x^2 \square y^2 \square 121z^2 \square z^2$

$\square x^2 \square 121z^2 \square z^2 \square y^2$ (4)

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

$x \square 11\square^2 \square 11\square^2 \square 2\square\square$

$y \square \square \square^2 \square \square^2 \square 22\square\square z \square\square^2 \square \square^2$

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

$x^2 \square y^2 \square 122z^2 \square 1$

Write 1 as

$1\square \frac{\square 3 \square 4i\square\square 3 \square 4i\square 25}{}$ (5)

(6)

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

$$\left.\begin{aligned} x &\square 29A^2 \square 29B^2 \square 94AB \\ y &\square 47A^2 \square 47B^2 \square 58AB \\ z &\square 5A^2 \square 5B^2 \end{aligned}\right\} \quad (7)$$

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 :

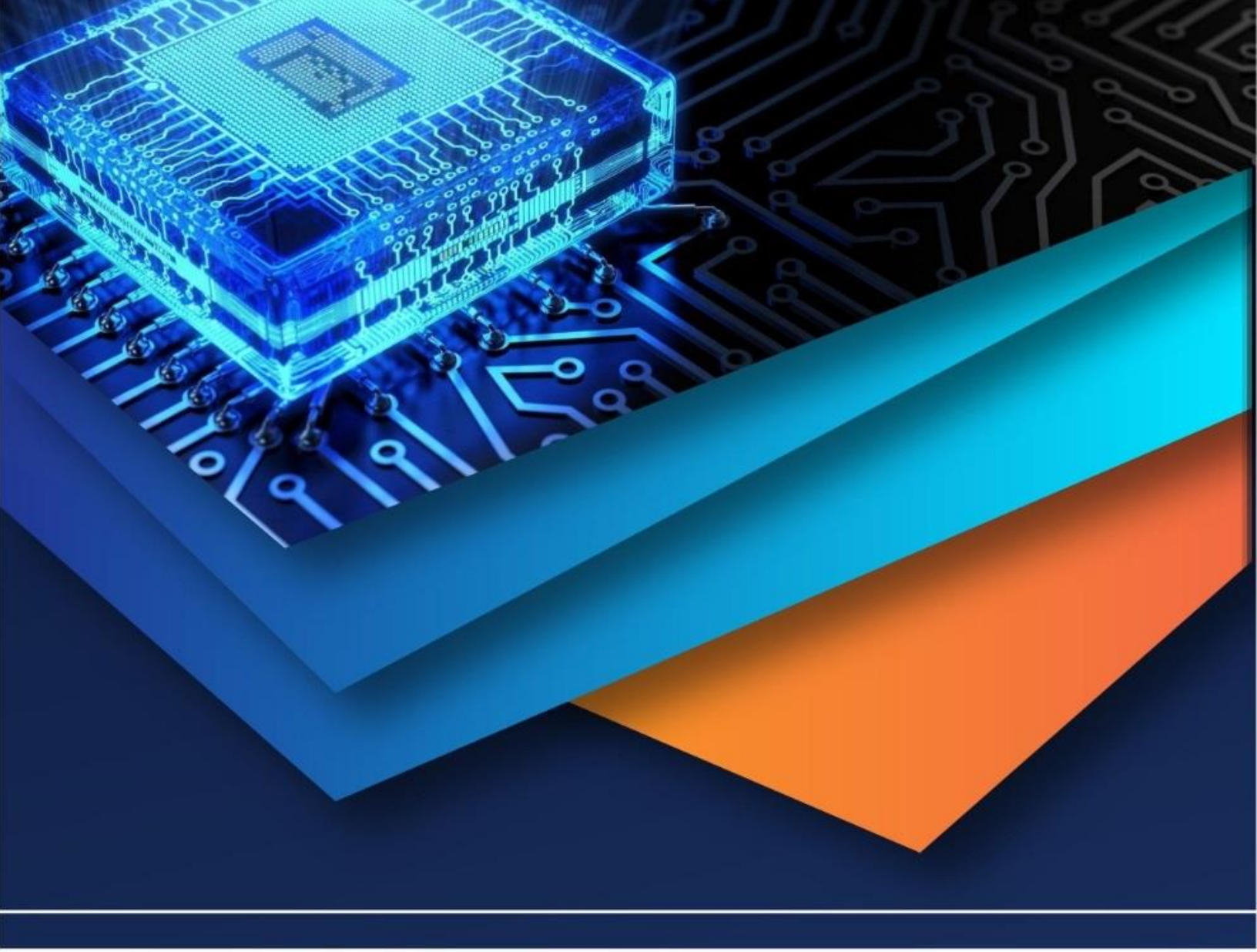
enter the value of c 5
5
enter the value of d 5
5
the value of x is -100
the value of y is -1100
the value of z is 100

III. CONCLUSION

In this paper, an bid has been created to get non-zero distinct integer results to the ternary quadratic Diophantineequation $x^2 \square y^2 \square 122 z^2$ 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.

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