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Special Rectangles and Narcissistic Numbers of Order 3 And 4

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Abstract— We search for infinitely many rectangles such that $x^2+y^2+3A-S^2+k^2+SK=$ ***Narcissistic numbers of order 3 and 4 respectively, in which x, y represents the length and breadth of the rectangle.***
Also the total number of rectangles satisfying the relation under consideration as well as primitive and non-primitive rectangles are also present.
Keywords—Rectangle, Narcissistic numbers of order 3 and 4, primitive,non-primitive.

I. INTRODUCTION

The older term for number theory is arithmetic, which was superseded as number theory by early twentieth century. The first historical find of an arithmetical nature is a fragment of a table, the broken clay tablet containing a list of Pythagorean triples. Since then the finding continues.

For more ideas and interesting facts one can refer [1].In [2] one can get ideas on pairs of rectangles dealing with non-zero integral pairs representing the length and breadth of rectangle. [3,4] has been studied for knowledge on rectangles in connection with perfect squares , Niven numbers and kepriker triples.[5-10] was referred for connections between Special rectangles and polygonal numbers, jarasandha numbers and dhuruva numbers

Recently in [11,12] special pythagorean triangles in connections with Narcissistic numbers are obtained.

In this communication, we search for infinitely many rectangles such that $x^2+y^2+3A-S^2+k^2+SK=$ Narcissistic numbers of order 3 and 4 respectively, in which x,y represents the length and breadth of the rectangle.

Also the total number of rectangles satisfying the relation under consideration as well as primitive and non-primitive rectangles are also present.

II. NOTATIONS

A-Area of the rectangle

S-Semi-perimeter of the rectangle

III. BASIC DEFINITIONS

Definition 1:Narcissistic Numbers

An n-digit number which is the sum of n^{th} power of its digits is called an n-narcissistic number. It is also known as Armstrong number.

Definition 2:Primitive Rectangle

A rectangle is said to be primitive if the generators u,v are of opposite parity and gcd(u,v) = 1, where

$x=u+v; y=u-v \quad and \quad u>v>0$

IV. METHOD OF ANALYSIS

Let x, y be two non-zero distinct positive integers representing the length and breadth of a rectangle R.Let $k\geq 0$ be any given integer.

The problem under consideration is to solve the equation

$$x^2+y^2+3A-S^2+k^2+Sk=\text{Narcissistic Number} \quad (1)$$

To solve (1),let us introduce the linear transformation $x=u+v$ and $y=u-v\ (u>v>0)$ (2)

Therfore (1) reduces to

$$(u+k)^2-v^2=\text{Narcissistic Number} \quad (3)$$

Case1:

Consider the 3^{rd} order Narcissistic Number 153.

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Therefore (3) becomes,

$$(u+k)^2 - v^2 = 153$$

Applying the method of factorization, we have

u+k	13	27	77
v	4	24	76

From the above mentioned values, the following results are observed.

TABLE I

k	No.of Rectangles related to 153	Observations
0	3	2 rectangles are primitive and one is non-primitive.
1,2	2	For k = 1,both the rectangles are non-primitive. For k = 2,both the rectangles are primitive.
3-8	1	For k = 3,5,7,8, the rectangles are non- primitive. For k = 4,6, the rectangles are primitive.

Case2:

Consider the 3rd order Narcissistic Number 371.

Therefore (3) becomes,

$$(u+k)^2 - v^2 = 371$$

Applying the method of factorization, we have

u+k	30	186
v	23	185

From the above mentioned values, the following results are observed.

TABLE II

k	No.of Rectangles related to 371	Observations
0	2	Both the rectangles are primitive
1-6	1	For k = 1,3,5, the rectangles are non-primitive For k = 2,4,6, the rectangles are primitive.

Case3:

Consider the 3rd order Narcissistic Number 407.

Therefore (3) becomes,

$$(u+k)^2 - v^2 = 407$$

Applying the method of factorization, we have

u+k	24	204
v	13	203

From the above mentioned values, the following results are observed.

TABLE III

k	No.of Rectangles related to 407	Observations
0	2	Both the rectangles are primitive
1-10	1	For k = 1,3,5,7,9, the rectangles are non-primitive For k = 2,4,6,8,10, the rectangles are primitive.

Case 4:

Consider the 4th order Narcissistic Number 8208.

Therefore (3) becomes,

$$(u+k)^2 - v^2 = 8208$$

Applying the method of factorization, we have

u+k	92	93	103	127	132	183	237	348	517	687	1028	2053
v	16	21	49	89	96	159	219	336	509	681	1024	2051

From the above mentioned values, the following results are observed.

TABLE IV

k	No.of Rectangles related to 8208	Observations
0,1	12	For k = 0 , all the rectangles are non-primitive For k = 1 , all the rectangles are primitive
2,3	11	For k = 2 , all the rectangles are non-primitive For k = 3 , there are 5 primitive and 6 non-primitive rectangles
4,5	10	For k = 4 , all the rectangles are non-primitive For k = 5 , there are 8 primitive and 2 non-primitive rectangles
6,7	9	For k = 6 , all the rectangles are non-primitive For k = 7 , all the rectangles are primitive
8-11	8	For k = 8,10 all the rectangles are non-primitive For k = 9 , there are 3 primitive and 5 non-primitive rectangles For k = 11 all the rectangles are primitive
12-17	7	For k = 12,14,16 all the rectangles are non-primitive For k = 13,17 all the rectangles are primitive For k = 15,there are 3 primitive and 4 non-primitive rectangles
18-23	6	For k = 18,20,22 all the rectangles are non-primitive For k = 19,23there are 5 primitive and 1 non-primitive rectangles For k = 21,there are 3 primitive and 3 non-primitive rectangles
24-35	5	For k = 24,26,28,30,32,34 all the rectangles are non-primitive For k = 25,29,31,35 all the rectangles are primitive For k = 27,there are 3 primitive and2 non-primitive rectangles For k = 33,there are 2 primitive and 3 non-primitive rectangles
36,37	4	For k = 36, all the rectangles are non-primitive For k = 37, there are 3 primitive and 1 non-primitive rectangles
38-53	3	For k = 38,40,42,44,46,48,50,52 all the rectangles are non-primitive For k = 41,43,49,53 all the rectangles are primitive

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		For k = 39,45,47,51 there are 2 primitive and 1 non-primitive rectangles
54-71	2	For k = 54,56,58,60,62,64,66,68,70 all the rectangles are non-primitive For k = 55,59,61,67,71 all the rectangles are primitive For k = 57,63,65,69 there are 1 primitive and 1 non-primitive rectangles
72-75	1	For k = 72,74 the rectangles is non-primitive For k = 73,75 the rectangles is primitive

V. CONCLUSION

To conclude, one may search for the connections between the rectangles and Narcissistic numbers of higher order and other number patterns.

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