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Special Rectangles and Narcissistic Numbers of Order 3 And 4

G.Janaki¹, P.Saranya²

^{1,2}Department of Mathematics, Cauvery College for women, Trichy-620018

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The older term for number theory is arithmetic, which was superseded as number theory by early twentieth century.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 nth power of its digits is called an n-narcissistic number. It is also known as Armstrong number.

Definition 2: Primitive Rectangle

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A rectangle is said to be primitive if the generators u,v are of opposite parity and gcd(u,v) = 1, where
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x = u + v; y = u - v and 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 $k \ge 0$ be any given integer.

The problem under consideration is to solve the equation

$x^{2} + y^{2} + 3A - S^{2} + k^{2} + Sk =$ Narcissistic Number	(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 = $ Narcissist ic Number	(3)
Case1:	

Consider the 3rd 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.
1,2	2	For $k = 2$, both the rectangles are primitive.
38	1	For $k = 3,5,7,8$, the rectangles are non- primitive.
5-0	1	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
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From the above mentioned values, the following results are observed.

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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	,1 12	For $k = 0$, all the rectangles are non-primitive
0,1		For $k = 1$, all the rectangles are primitive
2.2	11	For $k = 2$, all the rectangles are non-primitive
2,5	2,5 11	For $k = 3$, there are 5 primitive and 6 non-primitive rectangles
15	10	For $k = 4$, all the rectangles are non-primitive
4,5	10	For $k = 5$, there are 8 primitive and 2 non-primitive rectangles
67	0	For $k = 6$, all the rectangles are non-primitive
0,7	9	For $k = 7$, all the rectangles are primitive
		For $k = 8,10$ all the rectangles are non-primitive
8-11	8	For $k = 9$, there are 3 primitive and 5 non-primitive rectangles
		For $k = 11$ all the rectangles are primitive
		For $k = 12,14,16$ all the rectangles are non-primitive
12-17	7	For $k = 13,17$ all the rectangles are primitive
		For $k = 15$, there are 3 primitive and 4 non-primitive rectangles
		For $k = 18,20,22$ all the rectangles are non-primitive
18-23	6	For $k = 19,23$ there are 5 primitive and 1 non-primitive rectangles
		For $k = 21$, there are 3 primitive and 3 non-primitive rectangles
		For $k = 24,26,28,30,32,34$ all the rectangles are non-primitive
24.35	5	For $k = 25,29,31,35$ all the rectangles are primitive
24-33	5	For $k = 27$, there are 3 primitive and 2 non-primitive rectangles
		For $k = 33$, there are 2 primitive and 3 non-primitive rectangles
26.27	4	For $k = 36$, all the rectangles are non-primitive
50,57	4	For $k = 37$, there are 3 primitive and 1 non-primitive rectangles
38 52	3	For $k = 38,40,42,44,46,48,50,52$ all the rectangles are non-primitive
30-33	5	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
		For $k = 54,56,58,60,62,64,66,68,70$ all the rectangles are non-
54 71	2	primitive
54-71 2	2	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
70 75	1	For $k = 72,74$ the rectangles is non-primitive
12-15	1	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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