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Special pairs of rectangles and sphenic number

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***Abstract*— We present pairs of Rectangles, such that in each pair, the sum of their areas is two times the Sphenic number minus one. Also we present the number of pairs of primitive and non-primitive rectangles.**
***Keywords*— Pairs of Rectangles, Sphenic number, Primitive and non-primitive Rectangles.**

I. INTRODUCTION

Number theory is a broad and diverse part of Mathematics that developed from the study of the integers. Diophantine equations are numerously rich because of its variety. Diophantine problems have fewer equations that unknown variables and involve finding solutions in integers. There is no universal method available to know whether a Diophantine equation has a solution or finding all solutions if it exists. In this context one may refer **[1-4].**

A careful observer of patterns may note that there is a one to one correspondence between the polygonal numbers and the number of sides of the polygon. Apart from the above patterns we have some more fascinating patterns of numbers namely Nasty number, Dhuruva numbers and Jarasandha numbers. These numbers have presented in **[5-8]**. In **[9-14]**, special Pythagorean triangles connected with polygonal numbers and Nasty numbers are presented.

In this communication, we search for pairs of Rectangles, such that in each pair, the sum of their areas is two times the sphenic numbers minus one, where the Sphenic number which are divisible by three satisfies this relation.

II. BASIC DEFINITIONS

A. Definition1: Sphenic Number

Sphenic number is a positive integer that is the product of three distinct prime numbers.

B. Definition 2 : Primitive Rectangle

A primitive rectangle is a rectangle having integer sides a and b such that $\gcd(a,b)=1$.

III.METHOD OF ANALYSIS

Let R_1, R_2 be two distinct Rectangles with generators $u, w\,(u>w>0)$ and $v, w(v>w>0)$ respectively.

Let A_1, A_2 be the areas of R_1, R_2 such that

$$A_1 + A_2 = 2 \text{ times the Sphenic Number} - 1.$$

where the Sphenic number which are divisible by 3 satisfies the above relation.

The above relation which leads to the equation

$$u^2 + v^2 - 2w^2 = 2 \text{ Times the Sphenic Number} - 1.$$

After performing numerical computations we have presented below the values of u, v, w and the corresponding sphenic numbers.

Here we present 2-digit and 3-digit sphenic numbers which satisfies the above relation

TABLE I
RECTANGLE PAIRS AND SPHENIC NUMBERS

u	v	w	A_1	A_2	$\frac{A_1 + A_2 + 1}{2} = \text{Sphenic Number}$
11	10	9	40	19	30
15	14	13	56	27	42

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23	22	21	88	43	66
27	26	25	104	51	78
35	34	33	136	67	102
36	35	34	140	69	105
39	38	37	152	75	114
47	46	45	184	91	138
56	55	54	220	109	165
59	58	57	232	115	174
63	62	61	248	123	186
66	65	64	260	129	195
78	77	76	308	153	231
83	82	81	328	163	246
86	85	84	340	169	255
87	86	85	344	171	258
92	91	90	364	181	273
95	94	93	376	187	282
96	95	94	380	189	285
107	106	105	424	211	318
116	115	114	460	229	345
119	118	117	472	235	354
120	119	118	476	237	357
123	122	121	488	243	366
134	133	132	532	265	399
135	134	133	536	267	402
143	142	141	568	283	426
144	143	142	572	285	429
146	145	144	580	289	435
147	146	145	584	291	438
156	155	154	620	309	465
159	158	157	632	315	474
162	161	160	644	321	483
167	166	165	664	331	498
179	178	177	712	355	534
195	194	193	776	387	582
203	202	201	808	403	606
206	205	204	820	409	615
207	206	205	824	411	618
210	209	208	836	417	627
215	214	213	856	427	642
216	215	214	860	429	645
218	217	216	868	433	651
219	218	217	872	435	654
227	226	225	904	451	678
236	235	234	940	469	705
255	254	253	1016	507	762
260	259	258	1036	517	777
263	262	261	1048	523	786

266	265	264	1060	529	795
275	274	273	1096	547	822
279	278	277	1112	555	834
288	287	286	1148	573	861
296	295	294	1180	589	885
299	298	297	1192	595	895
300	299	298	1196	597	897
302	301	300	1204	601	903
303	302	301	1208	603	906
306	305	304	1220	609	915
315	314	313	1256	627	942
320	319	318	1276	637	957
324	323	322	1292	645	969
327	326	325	1304	651	978
330	329	328	1316	657	987

Thus it is seen that for each pair, the sum of the areas of a Rectangle is equal to twice the sphenic number minus one.
From the table 1, all the pairs of Rectangles are primitive. In each of the primitive pairs, one of the Rectangles is primitive and the other is non-primitive Rectangle.

IV. CONCLUSION

One may search for the connections between the pairs of Rectangles and the other sphenic numbers of higher order.

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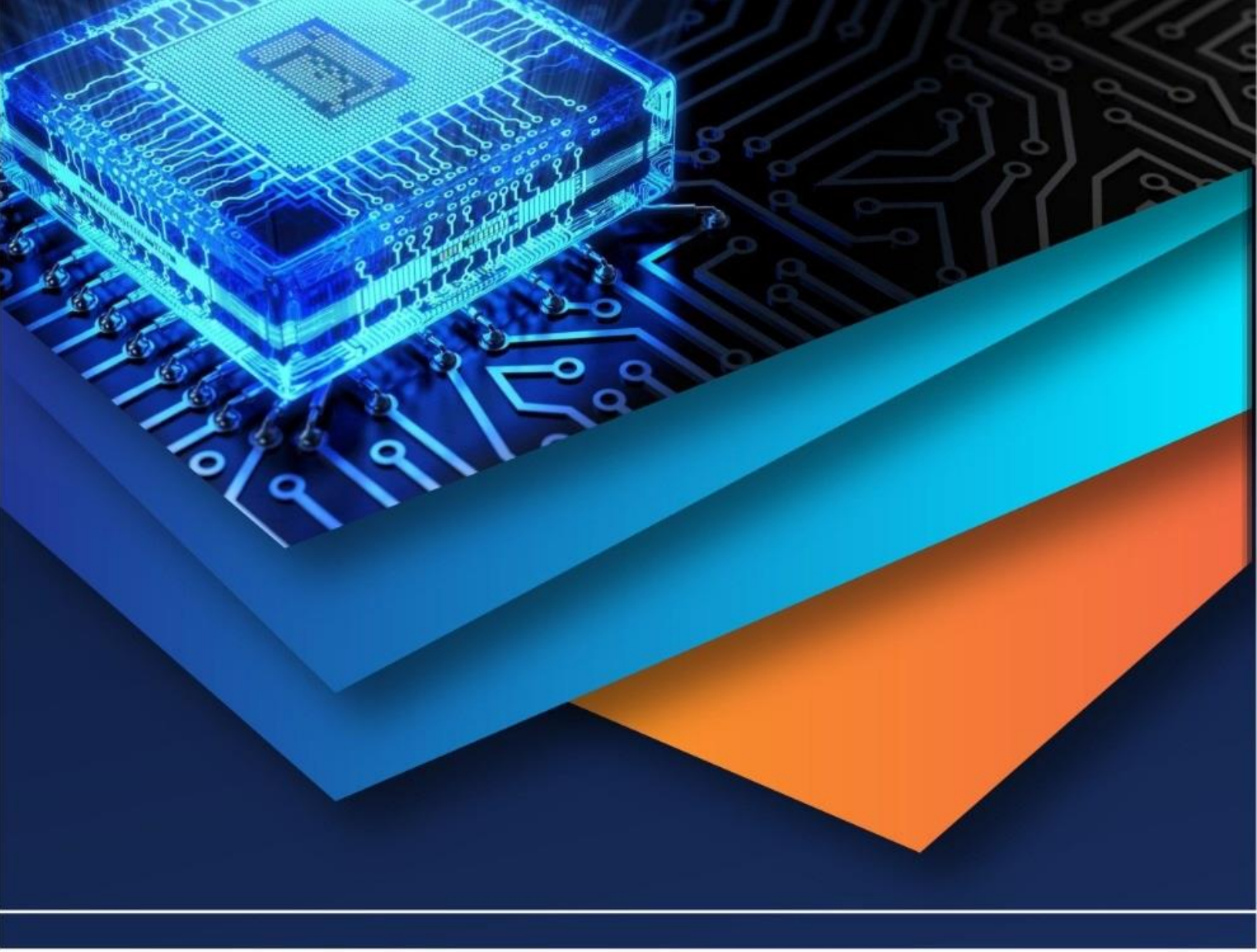

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