Introducing P^{Π} power series in number theory: A novel way to classify natural numbers

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Abstract

Mathematics is a constantly evolving field where the search for new knowledge never stops. Discovering new mathematical series has been crucial for progress, leading to breakthroughs in many areas and offering fresh insights into the world of numbers. In this paper, we describe a new series called the P^n power series. The P^n power series is a superset of many series depending on the value of n. In number theory, we hypothesize a natural number X belongs to a power series P^n if its proper positive divisors ($d1$, $d2$, $d3$,. . . , X) follow; X^n = $d1$ * $d2$ * $d3$ *. . . * X (where n = 1, 1.5, 2, 2.5, 3, etc.). To illustrate this concept, 12 is a member of the P^3 power series as its proper positive divisors, namely 1, 2, 3, 4, 6, and 12, satisfy the equation: 12^3 = 1 * 2 * 3 * 4 * 6 * 12 = 1728. Similarly, 196 belongs to the $P^{4.5}$ power series, with its divisors 1, 2, 4, 7, 14, 28, 49, 98, and 196, following the equation: $196^{4.5}$ = 1 * 2 * 4 * 7 * 14 * 28 * 49 * 98 * 196 = 20,661,046,784. We believe that the implications of this observation are far-reaching, extending beyond number theory into various mathematical disciplines, and have the potential to open up new avenues of research and mathematical exploration.

1. Introduction

Mathematics is a field of constant discovery, where novel concepts and series continually enrich our understanding of numbers and their intricate relationships [1, 2]. Uncovering new mathematical series cannot be overstated, as each breakthrough serves as a stepping stone to further our comprehension of the numerical world [3, 4]. The recent emergence of groundbreaking mathematical concepts joins the ranks of illustrious mathematical discoveries that have not only reshaped mathematical research but also found wide-ranging practical applications. Consider the historical significance of some of these discoveries to appreciate the potential applications of novel mathematical concepts. Prime numbers, those indivisible integers that are divisible only by themselves and 1, have long held a critical role in cryptography, ensuring the security of digital communication by providing a foundation for encryption and decryption [5-7]. Champion numbers or jumping champions, a relatively recent find, have applications in understanding consecutive primes [8, 9]. Abundant numbers, another intriguing class of integers, have uncovered essential insights into data analysis, cryptography, and algorithm design [10, 11]. Amicable numbers, with their harmonious pairings, have highlighted the elegant symmetries and relationships hidden within the realm of numbers, providing a source of a novel security model for password encryption [12]. Carmichael numbers, central to the study of number theory and primality testing, have found critical applications in developing computer algorithms and cryptography [13, 14]. Euler numbers, a family of integers with far-reaching influence, bridge the gap between mathematics and physics, appearing in a myriad of applications from calculus to number theory and even quantum field theory [15-17]. These examples illustrate the depth and breadth of impact that new mathematical discoveries can have, extending from pure mathematics into a vast array of practical applications that contribute to various aspects of our lives. The discovery of groundbreaking mathematical concepts represents yet another promising milestone in mathematical exploration, bringing with it the potential to unearth new applications and insights across a diverse range of fields. As we embark on this journey to decipher the mysteries and implications of these new mathematical concepts, we anticipate that they will prove to be transformative additions to the ever-evolving narrative of mathematical innovation and its practical applications. The unfolding story of mathematical discovery is a testament to humans' quest for knowledge and its power to illuminate the mysteries of our world.

In the present paper, we classified natural numbers into P^n power series utilizing the relation between the natural number X and the product of the divisors (d1, d2, ..., X) as per the equation: X^n = d1 * d2 * d3 *. . . *X. We successfully assigned the P^n power series to all the first million numbers and noted that P^{60} is the highest identified series.

2. Methods

The Python codes were written to generate a list of a million numbers and their respective proper positive divisors, followed by computing the product of the proper positive divisors and finally assigning the P^n power series.

3. Results and Discussion

The idea of classifying natural numbers to P^n power series was implemented to the first million numbers. Table 1 provides an insightful breakdown of these classifications utilizing the first 500 natural numbers, offering a comprehensive view of how the P^n series assignments were made based on the relationship between natural numbers and the product of their divisors. Table 1 consists of four columns, where the first column represents natural numbers X. Second column contains all the divisors of the respective number followed by the product of the divisors in the third column. Depending on the relationship between the natural number X and the product of the divisors, as per the relation; X^n = d1 * d2 * d3 *. . . * X, P^n series were assigned and tabulated in the fourth column of Table 1. The list of the first million numbers, along with their respective P^n power series, is provided in Table S1.

It is quite evident from Table 1 and Table S1 that each natural number can be classified into P^n power series. It is striking that all the prime numbers are members of the P^1 power series. The number 1 is not a member of the P^1 power series, as it has only one positive divisor, namely 1. Hence, we elegantly presented an alternative way of defining prime numbers. From the first million natural numbers chosen for testing the hypothesis, the highest power series obtained was P^{60}. A natural number that doesn't belong to any P^n power series is still unknown as per our analysis with the first million natural numbers. All the identified P^n power series, along with the first member of the series, are reported in Table 2.

Table 1: Assigning P^n power series to natural numbers

X	Proper positive divisors	Product of divisors	n in P^n
1	1	1	-
2	1, 2	2	1
3	1, 3	3	1
4	1, 2, 4	8	1.5
5	1, 5	5	1
6	1, 2, 3, 6	36	2
7	1, 7	7	1
8	1, 2, 4, 8	64	2
9	1, 3, 9	27	1.5
10	1, 2, 5, 10	100	2
11	1, 11	11	1
12	1, 2, 3, 4, 6, 12	1728	3
13	1, 13	13	1
14	1, 2, 7, 14	196	2
15	1, 3, 5, 15	225	2
16	1, 2, 4, 8, 16	1024	2.5
17	1, 17	17	1
18	1, 2, 3, 6, 9, 18	5832	3
19	1, 19	19	1
20	1, 2, 4, 5, 10, 20	8000	3
21	1, 3, 7, 21	441	2
22	1, 2, 11, 22	484	2
23	1, 23	23	1
24	1, 2, 3, 4, 6, 8, 12, 24	331776	4
25	1, 5, 25	125	1.5
26	1, 2, 13, 26	676	2
27	1, 3, 9, 27	729	2
28	1, 2, 4, 7, 14, 28	21952	3
29	1, 29	29	1
30	1, 2, 3, 5, 6, 10, 15, 30	810000	4
31	1, 31	31	1
32	1, 2, 4, 8, 16, 32	32768	3
33	1, 3, 11, 33	1089	2
34	1, 2, 17, 34	1156	2
35	1, 5, 7, 35	1225	2
36	1, 2, 3, 4, 6, 9, 12, 18, 36	10077696	4.5
37	1, 37	37	1
38	1, 2, 19, 38	1444	2
39	1, 3, 13, 39	1521	2
40	1, 2, 4, 5, 8, 10, 20, 40	2560000	4
41	1, 41	41	1
42	1, 2, 3, 6, 7, 14, 21, 42	3111696	4
43	1, 43	43	1
44	1, 2, 4, 11, 22, 44	85184	3
45	1, 3, 5, 9, 15, 45	91125	3
46	1, 2, 23, 46	2116	2
47	1, 47	47	1
48	1, 2, 3, 4, 6, 8, 12, 16, 24, 48	254803968	5
l49	1, 7, 49	343	1.5
50	1, 2, 5, 10, 25, 50	125000	3
51	1, 3, 17, 51	2601	2
52	1, 2, 4, 13, 26, 52	140608	3
53	1, 53	53	1
54	1, 2, 3, 6, 9, 18, 27, 54	8503056	4
55	1, 5, 11, 55	3025	2
56	1, 2, 4, 7, 8, 14, 28, 56	9834496	4
57	1, 3, 19, 57	3249	2
58	1, 2, 29, 58	3364	2
59	1, 59	59	1
60	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60	46656000000	6
61	1, 61	61	1

62	1, 2, 31, 62	3844	2
63	1, 3, 7, 9, 21, 63	250047	3
64	1, 2, 4, 8, 16, 32, 64	2097152	3.5
65	1, 5, 13, 65	4225	2
66	1, 2, 3, 6, 11, 22, 33, 66	18974736	4
67	1, 67	67	1
68	1, 2, 4, 17, 34, 68	314432	3
69	1, 3, 23, 69	4761	2
70	1, 2, 5, 7, 10, 14, 35, 70	24010000	4
71	1, 71	71	1
72	1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36,72	1.39314E+11	6
73	1, 73	73	1
74	1, 2, 37, 74	5476	2
75	1, 3, 5, 15, 25, 75	421875	3
76	1, 2, 4, 19, 38, 76	438976	3
77	1, 7, 11, 77	5929	2
78	1, 2, 3, 6, 13, 26, 39, 78	37015056	4
79	1, 79	79	1
80	1, 2, 4, 5, 8, 10, 16, 20, 40, 80	3276800000	5
81	1, 3, 9, 27, 81	59049	2.5
82	1, 2, 41, 82	6724	2
83	1, 83	83	1
84	1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84	3.51298E+11	6
85	1, 5, 17, 85	7225	2
86	1, 2, 43, 86	7396	2
87	1, 3, 29, 87	7569	2
88	1, 2, 4, 8, 11, 22, 44, 88	59969536	4
89	1, 89	89	1
90	1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90	5.31441E+11	6
91	1, 7, 13, 91	8281	2
92	1, 2, 4, 23, 46, 92	778688	3
93	1, 3, 31, 93	8649	2
94	1, 2, 47, 94	8836	2
95	1, 5, 19, 95	9025	2
96	1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 96	7.82758E+11	6
97	1, 97	97	1
98	1, 2, 7, 14, 49,98	941192	3
99	1, 3, 9, 11, 33, 99	970299	3
100	1, 2, 4, 5, 10, 20, 25, 50, 100	1000000000	4.5
101	1, 101	101	1
102	1, 2, 3, 6, 17, 34, 51, 102	108243216	4
103	1, 103	103	1
104	1, 2, 4, 8, 13, 26, 52, 104	116985856	4
105	1, 3, 5, 7, 15, 21, 35, 105	121550625	4
106	1, 2, 53, 106	11236	2
107	1, 107	107	1
108	1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 108	1.58687E+12	6
109	1, 109	109	1
110	1, 2, 5, 10, 11, 22, 55, 110	146410000	4
111	1, 3, 37, 111	12321	2
112	1, 2, 4, 7, 8, 14, 16, 28, 56, 112	17623416832	5
113	1, 113	113	1
114	1, 2, 3, 6, 19, 38, 57, 114	168896016	4
115	1, 5, 23, 115	13225	2
116	1, 2, 4, 29, 58, 116	1560896	3
117	1, 3, 9, 13, 39, 117	1601613	3
118	1, 2, 59, 118	13924	2
119	1, 7, 17, 119	14161	2
120	1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120	4.29982E+16	8
121	1, 11, 121	1331	1.5
122	1, 2, 61, 122	14884	2
123	1, 3, 41, 123	15129	2
124	1, 2, 4, 31, 62, 124	1906624	3
125	1, 5, 25, 125	15625	2

126	1, 2, 3, 6, 7, 9, 14, 18, 21, 42, 63, 126	4.0015E+12	6
127	1, 127	127	1
128	1, 2, 4, 8, 16, 32, 64, 128	268435456	4
129	1, 3, 43, 129	16641	2
130	1, 2, 5, 10, 13, 26, 65, 130	285610000	4
131	1, 131	131	1
132	1, 2, 3, 4, 6, 11, 12, 22, 33, 44, 66, 132	5.28985E+12	6
133	1, 7, 19, 133	17689	2
134	1, 2, 67, 134	17956	2
135	1, 3, 5, 9, 15, 27, 45, 135	332150625	4
136	1, 2, 4, 8, 17, 34, 68, 136	342102016	4
137	1, 137	137	1
138	1, 2, 3, 6, 23, 46, 69, 138	362673936	4
139	1, 139	139	1
140	1, 2, 4, 5, 7, 10, 14, 20, 28, 35, 70, 140	7.52954E+12	6
141	1, 3, 47, 141	19881	2
142	1, 2, 71, 142	20164	2
143	1,11, 13, 143	20449	2
144	1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48, 72, 144	1.54E+16	7.5
145	1, 5, 29, 145	21025	2
146	1, 2, 73, 146	21316	2
147	1, 3, 7, 21, 49, 147	3176523	3
148	1, 2, 4, 37, 74, 148	3241792	3
149	1, 149	149	1
150	1, 2, 3, 5, 6, 10, 15, 25, 30, 50, 75, 150	1.13906E+13	6
151	1, 151	151	1
152	1, 2, 4, 8, 19, 38, 76, 152	533794816	4
153	1, 3, 9, 17, 51, 153	3581577	3
154	1, 2, 7, 11, 14, 22, 77, 154	562448656	4
155	1, 5, 31, 155	24025	2
156	1, 2, 3, 4, 6, 12, 13, 26, 39, 52, 78, 156	1.44128E+13	6
157	1, 157	157	1
158	1, 2, 79, 158	24964	2
159	1, 3, 53, 159	25281	2
160	1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 80, 160	1.67772E+13	6
161	1, 7, 23, 161	25921	2
162	1, 2, 3, 6, 9, 18, 27, 54, 81, 162	1.11577E+11	5
163	1, 163	163	1
164	1, 2, 4, 41, 82, 164	4410944	3
165	1, 3, 5, 11, 15, 33, 55, 165	741200625	4
166	1, 2, 83, 166	27556	2
167	1, 167	167	1
168	1, 2, 3, 4, 6, 7, 8, 12, 14, 21, 24, 28, 42, 56, 84, 168	6.34562E+17	8
169	1, 13, 169	2197	1.5
170	1, 2, 5, 10, 17, 34, 85, 170	835210000	4
171	1, 3, 9, 19, 57, 171	5000211	3
172	1, 2, 4, 43, 86, 172	5088448	3
173	1, 173	173	1
174	1, 2, 3, 6, 29, 58, 87, 174	916636176	4
175	1, 5, 7, 25, 35, 175	5359375	3
176	1, 2, 4, 8, 11, 16, 22, 44, 88, 176	1.68874E+11	5
177	1, 3, 59, 177	31329	2
178	1, 2, 89, 178	31684	2
179	1, 179	179	1
180	1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 30, 36, 45, 60, 90, 180	1.98359E+20	9
181	1, 181	181	1
182	1, 2, 7, 13, 14, 26, 91, 182	1097199376	4
183	1, 3, 61, 183	33489	2
184	1, 2, 4, 8, 23, 46, 92, 184	1146228736	4
185	1, 5, 37, 185	34225	2
186	1, 2, 3, 6, 31, 62, 93, 186	1196883216	4
187	1, 11, 17, 187	34969	2
188	1, 2, 4, 47, 94, 188	6644672	3
189	1, 3, 7, 9, 21, 27, 63, 189	1275989841	4

190	1, 2, 5, 10, 19, 38, 95, 190	1303210000	4
191	1, 191	191	1
192	1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 64, 96, 192	9.61853E+15	7
193	1, 193	193	1
194	1, 2, 97, 194	37636	2
195	1, 3, 5, 13, 15, 39, 65, 195	1445900625	4
196	1, 2, 4, 7, 14, 28, 49, 98, 196	20661046784	4.5
197	1, 197	197	1
198	1, 2, 3, 6, 9, 11, 18, 22, 33, 66, 99, 198	6.02547E+13	6
199	1, 199	199	1
200	1, 2, 4, 5, 8, 10, 20, 25, 40, 50, 100, 200	6.4E+13	6
201	1, 3, 67, 201	40401	2
202	1, 2, 101, 202	40804	2
203	1, 7, 29, 203	41209	2
204	1, 2, 3, 4, 6, 12, 17, 34, 51, 68, 102, 204	7.20744E+13	6
205	1, 5, 41, 205	42025	2
206	1, 2, 103, 206	42436	2
207	1, 3, 9, 23, 69, 207	8869743	3
208	1, 2, 4, 8, 13, 16, 26, 52, 104, 208	3.89329E+11	5
209	1, 11, 19, 209	43681	2
210	1, 2, 3, 5, 6, 7, 10, 14, 15, 21, 30, 35, 42, 70, 105, 210	3.78229E+18	8
211	1, 211	211	1
212	1, 2, 4, 53, 106, 212	9528128	3
213	1, 3, 71, 213	45369	2
214	1, 2, 107, 214	45796	2
215	1, 5, 43, 215	46225	2
216	1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 27, 36, 54, 72, 108, 216	4.73838E+18	8
217	1, 7, 31, 217	47089	2
218	1, 2, 109, 218	47524	2
219	1, 3, 73, 219	47961	2
220	1, 2, 4, 5, 10, 11, 20, 22, 44, 55, 110, 220	1.1338E+14	6
221	1, 13, 17, 221	48841	2
222	1, 2, 3, 6, 37, 74, 111, 222	2428912656	4
223	1, 223	223	1
224	1, 2, 4, 7, 8, 14, 16, 28, 32, 56, 112, 224	1.26325E+14	6
225	1, 3, 5, 9, 15, 25, 45, 75, 225	38443359375	4.5
226	1, 2, 113, 226	51076	2
227	1, 227	227	1
228	1, 2, 3, 4, 6, 12, 19, 38, 57, 76, 114, 228	1.40478E+14	6
229	1, 229	229	1
230	1, 2, 5, 10, 23, 46, 115, 230	2798410000	4
231	1, 3, 7, 11, 21, 33, 77, 231	2847396321	4
232	1, 2, 4, 8, 29, 58, 116, 232	2897022976	4
233	1, 233	233	1
234	1, 2, 3, 6, 9, 13, 18, 26, 39, 78, 117, 234	1.64171E+14	6
235	1, 5, 47, 235	55225	2
236	1, 2, 4, 59, 118, 236	13144256	3
237	1, 3, 79, 237	56169	2
238	1, 2, 7, 14, 17, 34, 119, 238	3208542736	4
239	1, 239	239	1
240	1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 40, 48, 60, 80, 120, 240	6.34034E+23	10
241	1, 241	241	1
242	1, 2, 11, 22, 121, 242	14172488	3
243	1, 3, 9, 27, 81, 243	14348907	3
244	1, 2, 4, 61, 122, 244	14526784	3
245	1, 5, 7, 35, 49, 245	14706125	3
246	1, 2, 3, 6, 41, 82, 123, 246	3662186256	4
247	1, 13, 19, 247	61009	2
248	1, 2, 4, 8, 31, 62, 124, 248	3782742016	4
249	1, 3, 83, 249	62001	2
250	1, 2, 5, 10, 25, 50, 125, 250	3906250000	4
251	1, 251	251	1
252	1, 2, 3, 4, 6, 7, 9, 12, 14, 18, 21, 28, 36, 42, 63, 84, 126, 252	4.09831E+21	9
253	1, 11, 23, 253	64009	2

254	1, 2, 127, 254	64516	2
255	1, 3, 5, 15, 17, 51, 85, 255	4228250625	4
256	1, 2, 4, 8, 16, 32, 64, 128, 256	68719476736	4.5
257	1, 257	257	1
258	1, 2, 3, 6, 43, 86, 129, 258	4430766096	4
259	1, 7, 37, 259	67081	2
260	1, 2, 4, 5, 10, 13 20, 26, 52, 65, 130, 260	3.08916E+14	6
261	1, 3, 9, 29, 87, 261	17779581	3
262	1, 2, 131, 262	68644	2
263	1, 263	263	1
264	1, 2, 3, 4, 6, 8, 11, 12, 22, 24, 33, 44, 66, 88, 132, 264	2.35956E+19	8
265	1, 5, 53, 265	70225	2
266	1, 2, 7, 14, 19, 38, 133, 266	5006411536	4
267	1, 3, 89, 267	71289	2
268	1, 2, 4, 67, 134, 268	19248832	3
269	1, 269	269	1
270	1, 2, 3, 5, 6, 9, 10, 15, 18, 27, 30, 45, 54, 90, 135, 270	2.8243E+19	8
271	1, 271	271	1
272	1, 2, 4, 8, 16, 17, 34, 68, 136, 272	1.48883E+12	5
273	1, 3, 7, 13, 21, 39, 91, 273	5554571841	4
274	1, 2, 137, 274	75076	2
275	1, 5, 11, 25, 55, 275	20796875	3
276	1, 2, 3, 4, 6, 12, 23, 46, 69, 92, 138, 276	4.42033E+14	6
277	1, 277	277	1
278	1, 2, 139, 278	77284	2
279	1, 3, 9, 31, 93, 279	21717639	3
280	1, 2, 4, 5, 7, 8, 10, 14, 20, 28, 35, 40, 56, 70, 140, 280	3.77802E+19	8
281	1, 281	281	1
282	1, 2, 3, 6, 47, 94, 141, 282	6324066576	4
283	1, 283	283	1
284	1, 2, 4, 71, 142, 284	22906304	3
285	1, 3, 5, 15, 19, 57, 95, 285	6597500625	4
286	1, 2, 11, 13, 22, 26, 143, 286	6690585616	4
287	1, 7, 41, 287	82369	2
288	1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 32, 36, 48, 72, 96, 144, 288	1.36311E+22	9
289	1, 17, 289	4913	1.5
290	1, 2, 5, 10, 29, 58, 145, 290	7072810000	4
291	1, 3, 97, 291	84681	2
292	1, 2, 4, 73, 146, 292	24897088	3
293	1, 293	293	1
294	1, 2, 3, 6, 7, 14, 21, 42, 49, 98, 147, 294,	6.45779E+14	6
295	1, 5, 59, 295	87025	2
296	1, 2, 4, 8, 37, 74, 148, 296	7676563456	4
297	1, 3, 9, 11, 27, 33, 99, 297	7780827681	4
298	1, 2, 149, 298	88804	2
299	1, 13, 23, 299	89401	2
300	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 25, 30, 50, 60, 75, 100,150, 300	1.9683E+22	9
301	1, 7, 43, 301	90601	2
302	1, 2, 151, 302	91204	2
303	1, 3, 101, 303	91809	2
304	1, 2, 4, 16, 19, 76, 152, 304	8540717056	4
305	1, 5, 61, 305	93025	2
306	1, 2, 3, 6, 9, 17, 18, 34, 51, 102, 153, 306	8.20972E+14	6
307	1, 307	307	1
308	1, 2, 4, 7, 11, 14, 22, 28, 44, 77, 154, 308	8.53698E+14	6
309	1, 3, 103, 309	95481	2
310	1, 2, 5, 10, 31, 62, 155, 310	9235210000	4
311	1, 311	311	1
312	1, 2, 3, 4, 6, 8, 12, 13, 24, 26, 39, 52, 78, 104, 156, 312	8.97918E+19	8
313	1, 313	313	1
314	1, 2, 157, 314	98596	2
315	1, 3, 5, 7, 9, 15, 21, 35, 45, 63, 105, 315	9.7693E+14	6
316	1, 2, 4, 79, 158, 316	31554496	3
317	1, 317	317	1

318	1, 2, 3, 6, 53, 106, 159, 318	10226063376	4
319	1, 11, 29, 319	101761	2
320	1, 2, 4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 160, 320	3.43597E+17	7
321	1, 3, 107, 321	103041	2
322	1, 2, 7, 14, 23, 46, 161, 322	10750371856	4
323	1, 17, 19, 323	104329	2
324	1, 2, 3, 4, 6, 9, 12, 18, 27, 36, 54, 81, 108, 162, 324	6.74664E+18	7.5
325	1, 5, 13, 25, 65, 325	34328125	3
326	1, 2, 163, 326	106276	2
327	1, 3, 109, 327	106929	2
328	1, 2, 4, 8, 41, 82, 164, 328	11574317056	4
329	1, 7, 47, 329	108241	2
330	1, 2, 3, 5, 6, 10, 11, 15, 22, 30, 33, 55, 66, 110, 165, 330	1.40641E+20	8
331	1, 331	331	1
332	1, 2, 4, 83, 166, 332	36594368	3
333	1, 3, 9, 37, 111, 333	36926037	3
334	1, 2, 167, 334	111556	2
335	1, 5, 67, 335	112225	2
336	1, 2, 3, 4, 6, 7, 8, 12, 14, 16, 21, 24, 28, 42, 48, 56, 84, 112, 168, 336	1.83397E+25	10
337	1, 337	337	1
338	1, 2, 13, 26, 169, 338	38614472	3
339	1, 3, 113, 339	114921	2
340	1, 2, 4, 5, 10, 17, 20, 34, 68, 85, 170, 340	1.5448E+15	6
341	1, 11, 31, 341	116281	2
342	1, 2, 3, 6, 9, 18, 19, 38, 57, 114, 171, 342	1.60014E+15	6
343	1, 7, 49, 343	117649	2
344	1, 2, 4, 8, 43, 86, 172, 344	14003408896	4
345	1, 3, 5, 15, 23, 69, 115, 345	14166950625	4
346	1, 2, 173, 346	119716	2
347	1, 347	347	1
348	1, 2, 3, 4, 6, 12, 29, 58, 87, 116, 174, 348	1.77613E+15	6
349	1, 349	349	1
350	1, 2, 5, 7, 10, 14, 25, 35, 50, 70, 175, 350	1.83827E+15	6
351	1, 3, 9, 13, 27, 39, 117, 351	15178486401	4
352	1, 2, 4, 8, 11, 16, 22, 32, 44, 88, 176, 352	1.9022E+15	6
353	1, 353	353	1
354	1, 2, 3, 6, 59, 118, 177, 354	15704099856	4
355	1, 5, 71, 355	126025	2
356	1, 2, 4, 89, 178, 356	45118016	3
357	1, 3, 7, 17, 21, 51, 119, 357	16243247601	4
358	1, 2, 179, 358	128164	2
359	1, 359	359	1
360	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 40, 45, 60, 72, 90, 120, 180, 360	4.73838E+30	12
361	1, 19, 361	6859	1.5
362	1, 2, 181, 362	131044	2
363	1, 3, 11, 33, 121, 363	47832147	3
364	1, 2, 4, 7, 13, 14, 26, 28, 52, 91, 182, 364	2.32599E+15	6
365	1, 5, 73, 365	133225	2
366	1, 2, 3, 6, 61, 122, 183, 366	17944209936	4
367	1, 367	367	1
368	1, 2, 4, 8, 16, 23, 46, 92, 184, 368,	6.74899E+12	5
369	1, 3, 9, 41, 123, 369	50243409	3
370	1, 2, 5, 10, 37, 74, 185, 370	18741610000	4
371	1, 7, 53, 371	137641	2
372	1, 2, 3, 4, 6, 12, 31, 62, 93, 124, 186, 372	2.65007E+15	6
373	1, 373	373	1
374	1, 2, 11, 17, 22, 34, 187, 374	19565295376	4
375	1, 3, 5, 15, 25, 75, 125, 375	19775390625	4
376	1, 2, 4, 8, 47, 94, 188, 376	19987173376	4
377	1, 13, 29, 377	142129	2
378	1, 2, 3, 6, 7, 9, 14, 18, 21, 27, 42, 54, 63, 126, 189, 378	4.16806E+20	8
379	1, 379	379	1
380	1, 2, 4, 5, 10, 19, 20, 38, 76, 95, 190, 380	3.01094E+15	6
381	1, 3, 127, 381	145161	2

382	1, 2, 191, 382	145924	2
383	1, 383	383	1
384	1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 64, 96, 128, 192, 384	4.7277E+20	8
385	1, 5, 7, 11, 35, 55, 77, 385	21970650625	4
386	1, 2, 193, 386	148996	2
387	1, 3, 9, 43, 129, 387	57960603	3
388	1, 2, 4, 97, 194, 388	58411072	3
389	1, 389	389	1
390	1, 2, 3, 5, 6, 10, 13, 15, 26, 30, 39, 65, 78, 130, 195, 390	5.35201E+20	8
391	1, 17, 23, 391	152881	2
392	1, 2, 4, 7, 8, 14, 28, 49, 56, 98, 196, 392	3.62841E+15	6
393	1, 3, 131, 393	154449	2
394	1, 2, 197, 394	155236	2
395	1, 5, 79, 395	156025	2
396	1, 2, 3, 4, 6, 9, 11, 12, 22, 18, 33, 36, 44, 66, 99, 132, 198, 396	2.39473E+23	9
397	1, 397	397	1
398	1, 2, 199, 398	158404	2
399	1, 3, 7, 19, 21, 57, 133, 399	25344958401	4
400	1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 200, 400	3.2768E+19	7.5
401	1, 401	401	1
402	1, 2, 3, 6, 67, 134, 201, 402	26115852816	4
403	1, 13, 31, 403	162409	2
404	1, 2, 4, 101, 202, 404	65939264	3
405	1, 3, 5, 9, 15, 27, 45, 81, 135, 405	1.08962E+13	5
406	1, 2, 7, 14, 29, 58, 203, 406	27170906896	4
407	1, 11, 37, 407	165649	2
408	1, 2, 3, 4, 6, 8, 12, 17, 24, 34, 51, 68, 102, 136, 204, 408	7.67859E+20	8
409	1, 409	409	1
410	1, 2, 5, 10, 41, 82, 205, 410	28257610000	4
411	1, 3, 137, 411	168921	2
412	1, 2, 4, 103, 206, 412	69934528	3
413	1, 7, 59, 413	170569	2
414	1, 2, 3, 6, 9, 18, 23, 46, 69,138, 207, 414	5.03503E+15	6
415	1, 5, 83, 415	172225	2
416	1, 2, 4, 8, 13, 16, 26, 32, 52, 104,208, 416	5.18275E+15	6
417	1, 3, 139, 417	173889	2
418	1, 2, 11, 19, 22, 38, 209, 418	30528476176	4
419	1, 419	419	1
420	1, 2, 3, 4, 5, 6, 7, 10, 12, 14, 15, 20, 21, 28, 30, 35, 42, 60, 70, 84, 105, 140, 210, 420	3.01295E+31	12
421	1, 421	421	1
422	1, 2, 211, 422	178084	2
423	1, 3, 9, 47, 141, 423	75686967	3
424	1, 2, 4, 8, 53, 106, 212, 424	32319410176	4
425	1, 5, 17, 25, 85, 425	76765625	3
426	1, 2, 3, 6, 71, 142, 213, 426	32933538576	4
427	1, 7, 61, 427	182329	2
428	1, 2, 4, 107, 214, 428	78402752	3
429	1, 3, 11, 13, 33, 39, 143, 429	33871089681	4
430	1, 2, 5, 10, 43, 86, 215, 430	34188010000	4
431	1, 431	431	1
432	1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 27, 36, 48, 54, 72, 108, 144, 216, 432	2.2638E+26	10
433	1, 433	433	1
434	1, 2, 7, 14, 31, 62, 217, 434	35477982736	4
435	1, 3, 5, 15, 29, 87, 145, 435	35806100625	4
436	1, 2, 4, 109, 218, 436	82881856	3
437	1, 19, 23, 437	190969	2
438	1, 2, 3, 6, 73, 146, 219, 438	36804120336	4
439	1, 439	439	1
440	1, 2, 4, 5, 8, 10, 11, 20, 22, 40, 44, 55, 88, 110, 220, 440	1.40482E+21	8
441	1, 3, 7, 9, 21, 49, 63, 147, 441	7.9428E+11	4.5
442	1, 2, 13, 17, 26, 34, 221, 442	38167092496	4
443	1, 443	443	1
444	1, 2, 3, 4, 6, 12, 37, 74, 111, 148, 222, 444	7.66122E+15	6
445	1, 5, 89, 445	198025	2

446	1, 2, 223, 446	198916	2
447	1, 3, 149, 447	199809	2
448	1, 2, 4, 7, 8, 14, 16, 28, 32, 56, 64, 112, 224, 448	3.62198E+18	7
449	1, 449	449	1
450	1, 2, 3, 5, 6, 9, 10, 15, 18, 25, 30, 45, 50, 75, 90, 150, 225, 450	7.56681E+23	9
451	1, 11, 41, 451	203401	2
452	1, 2, 4, 113, 226, 452	92345408	3
453	1, 3, 151, 453	205209	2
454	1, 2, 227, 454	206116	2
455	1, 5, 7, 13, 35, 65, 91, 455	42859350625	4
456	1, 2, 3, 4, 6, 8, 12, 19, 24, 38, 57, 76, 114, 152, 228, 456	1.87E+21	8
457	1, 457	457	1
458	1, 2, 229, 458	209764	2
459	1, 3, 9, 17, 27, 51, 153, 459	44386483761	4
460	1, 2, 4, 5, 10, 20, 23, 46, 92, 115, 230, 460	9.4743E+15	6
461	1, 461	461	1
462	1, 2, 3, 6, 7, 11, 14, 21, 22, 33, 42, 66, 77, 154, 231, 462	2.07556E+21	8
463	1, 463	463	1
464	1, 2, 4, 8, 16, 29, 58, 116, 232, 464	2.15075E+13	5
465	1, 3, 5, 15 31, 93, 155, 465	46753250625	4
466	1, 2, 233, 466	217156	2
467	1, 467	467	1
468	1, 2, 3, 4, 6, 9, 12, 13, 18, 26, 36, 39, 52, 78, 117, 156, 234, 468	1.08E+24	9
469	1, 7, 67, 469	219961	2
470	1, 2, 5, 10, 47, 94, 235, 470	48796810000	4
471	1, 3, 157, 471	221841	2
472	1, 2, 4, 8, 59, 118, 236, 472	49632710656	4
473	1, 11, 43, 473	223729	2
474	1, 2, 3, 6, 79, 158, 237, 474	50479304976	4
475	1, 5, 19, 25, 95, 475	107171875	3
476	1, 2, 4, 7, 14, 17, 28, 34, 68, 119, 238, 476	1.16317E+16	6
477	1, 3, 9, 53, 159, 477	108531333	3
478	1, 2, 239, 478	228484	2
479	1, 479	479	1
480	1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 32, 40, 48, 60, 80, 96, 120, 160, 240, 480	1.49587E+32	12
481	1, 13, 37, 481	231361	2
482	1, 2, 241, 482	232324	2
483	1, 3, 7, 21, 23, 69, 161, 483	54423757521	4
484	1, 2, 4, 11, 22, 44, 121, 242, 484	1.20727E+12	4.5
485	1, 5, 97, 485	235225	2
486	1, 2, 3, 6, 9, 18, 27, 54, 81, 162, 243, 486	1.3177E+16	6
487	1, 487	487	1
488	1, 2, 4, 8, 61, 122, 244, 488	56712564736	4
489	1, 3, 163, 489	239121	2
490	1, 2, 5, 7, 10, 14, 35, 49, 70, 98, 245, 490	1.38413E+16	6
491	1, 491	491	1
492	1, 2, 3, 4, 6, 12, 41, 82, 123, 164, 246, 492	1.41837E+16	6
493	1, 17, 29, 493	243049	2
494	1, 2, 13, 19, 26, 38, 247, 494	59553569296	4
495	1, 3, 5, 9, 11, 15, 33, 45, 55, 99, 165, 495	1.47106E+16	6
496	1, 2, 4, 8, 16, 31, 62, 124, 248, 496	3.00198E+13	5
497	1, 7, 71, 497	247009	2
498	1, 2, 3, 6, 83, 166, 249, 498	61505984016	4
499	1, 499	499	1
500	1, 2, 4, 5, 10, 20, 25, 50, 100, 125, 250, 500	1.5625E+16	6

Table 2: P^n power series along with the first member of the series

P^n power series	First member	P^n power series	First member	P^n power series	First member
1	2	15	720	35	25920
1.5	4	16	840	36	10080
2	6	16.5	9216	37.5	32400
2.5	16	17	196608	38.5	746496
3	12	17.5	5184	39	184320
3.5	64	18	1260	40	15120
4	24	19	786432	40.5	44100
4.5	36	19.5	36864	42	20160
5	48	20	1680	44	107520
5.5	1024	21	2880	45	25200
6	60	22	15360	48	27720
6.5	4096	22.5	3600	49	233280
7	192	24	2520	49.5	230400
7.5	144	24.5	46656	50	45360
8	120	25	6480	52	430080
8.5	65536	25.5	589824	52.5	129600
9	180	26	61440	54	50400
9.5	262144	27	6300	54	509600
10	240	27.5	82944	56	60480
10.5	576	28	6720	60	55440
11	3072	30	5040		
12	360	31.5	14400		
12.5	1296	32	7560		
13	12288	32.5	331776		
13.5	900	33	46080		
14	960	34	983040		

4. Conclusions

The importance of discovering new mathematical series, such as P^n power series, cannot be overstated. These series serve as the building blocks of mathematical exploration, enabling us to comprehend the intricacies of numbers and their relationships in new and profound ways. We believe that the emergence of P^n power series is a concept that promises to reshape our understanding of natural numbers and open doors to uncharted territories in mathematics. This discovery is not just a theoretical novelty; it carries immense practical significance, much like the discovery of prime numbers, champion numbers, abundant numbers, amicable numbers, Brier numbers, Demlo numbers, Carmichael numbers, and Euler numbers, each of which has found a multitude of applications in diverse domains. These series, once discovered, transcend their theoretical origins and find themselves at the forefront of various practical applications. As we embark on a journey to understand this newfound series, we anticipate that it will reveal its own set of applications and insights, enriching not only the realm of pure mathematics but also the practical aspects of our lives. The discovery of the P^n power series adds yet another intriguing chapter to the ongoing mathematical story of innovation and application.

Conflict of Interest

The author declares no conflict of Interest

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