

# On the Computation of Primes & Semi-Primes

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Abstract: "Featuring the PF5 Function"

- 1> Primes may be created with a '*Primes From 5*' function:
- 2>  $PF5(N) = (N*3) + 1$  if N is even
- 3>  $+ 2$  if N is odd                      For  $N > 0$  & Integer
- 4> Outputs both Primes & Semi-Primes though is largely unchecked
- 5> Primes arise from 'P' input values
- 6> Semi-Primes arise from 'SP' input values

P inputs giving Primes	SP inputs giving Semi-Primes
1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 17, 19, 20, 22-24, 26, 27, 29, 32-37, 42, 43, 45, 46, 49, 50, 52, 54, 55, 57, 59, 60, 63-66, 70, 74-77, 79, 80, 83, 85, 87, 89, 90, 92-94, 97, 102-105 ...	8, 11, 16, 18, 21, 25, 28, 30, 31, 38, 39, 40, 41, 44, 47, 48, 51, 53, 56, 58, 61, 62, 67, 68, 69, 71-73, 78, 81, 82, 84, 86, 88, 91, 95, 96, 98-101 ...
(60% of the time for $N < 101$ )	(40% of the time for $N < 101$ )
Eg: $5*3+2 = 17$ (Prime) $12*3+1 = 37$ (Prime)	Eg: $11*3+2=35$ (Semi-Prime) $16*3+1=49$ (Semi-Prime)

Fig 1: Low-Order PF5 Inputs

- 7> SP inputs show a pattern & can be predicted
- 8> Omit SP inputs to give (desired) prime-only output

9> The SP inputs conform to lists which are initiated by a given root and which contain predictable even/odd values which produce multiples of the root as their Semi-Prime output

Root	Square	N	P+Q	Interval	SP Inputs
5	25	8	3+7	10	8, 11, 18, 21, 28, 31, 38, 41, 48, 51...
7	49	16	9+5	14	16, 25, 30, 39, 44, 53, 58, 67, 72, 81...
11	121	40	7+15	22	40, 47, 62, 69, 84, 91, 106, 113, 128...
13	169	56	17+9	26	56, 73, 82, 99, 108, 125, 134, 151...
17	289	96	11+23	34	96, 107, 130, 141, 164, 175, 198...
19	361	120	25+13	38	120, 145, 158, 183, 196, 221, 234...
23	529	176	15+31	46	176, 191, 222, 237, 268, 283, 314...
25	625	208	33+17	50	208, 241, 258, 291, 308, 341, 358...
29	841	280	19+39	58	280, 299, 338, 357, 396, 415, 454...
31	961	320	41+21	62	320, 361, 382, 423, 444, 485, 506...
35	1225	408	23+47	70	408, 431, 478, 501, 548, 571, 618...
37	1369	456	49+25	74	456, 505, 530, 579, 604, 653, 678...
41	1681	560	27+55	82	560, 587, 642, 669, 724, 751, 806...
43	1849	616	57+29	86	616, 673, 702, 759, 788, 845, 874...
47	2209	736	31+63	94	736, 767, 830, 861, 924, 955, 1018...

Fig 2: PF5 List-Based Analysis

10> The P+Q values are the 'magic' numbers that help computation

11> Smallest P or Q increments by 2 and flips position

12> Greatest P or Q increments by {2, 6} and flips position

13> Interval First-Difference is {4, 8}

14> Interval between successive even/odd SP inputs is P+Q

15> Adding P then Q gives next\_odd then next\_even term

Q: Does the pattern in the SP inputs to the PF5 function hold true?

### **References:**

<http://empslocal.ex.ac.uk/people/staff/mrwatkin/zeta/first10000primes.txt>

<http://en.wikipedia.org>