

History of Math HW21

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$$1) \mu(n) \begin{cases} 1 & \text{if } n = 1 \\ 0 & \text{if } n \text{ is not square-free} \\ (-1)^k & \text{otherwise where } k \text{ is the number of distinct prime factors} \end{cases}$$

$$M(n) = \sum_{i=1}^n \mu(i)$$

n	$\mu(n)$	M(n)
1	1	1
2	-1	0
3	-1	-1
4	0	-1
5	-1	-2
6	1	-1
7	-1	-2
8	0	-2
9	0	-2
10	1	-1
11	-1	-2
12	0	-2
13	-1	-3
14	1	-2
15	1	-1
16	0	-1
17	-1	-2
18	0	-2
19	-1	-3
20	0	-3

2) Verify Goldbach conjecture for all even integers between 4 and 30

$$n=4, 4=2+2$$

$$n=6, 6=3+3$$

$$n=8, 8=5+3$$

$$n=10, 10=7+3$$

$$n=12, 7+5$$

$$n=14, 14=11+3$$

$n=16, 16=13+3$

$n=18, 18=13+5$

$n=20, 20=17+3$

$n=22, 22=19+3$

$n=24, 24=19+5$

$n=26, 26=23+3$

$n=28, 28=23+5$

$n=30, 30=23+7$

3) All sets of twin primes where **both** elements are **less than 30** are {3,5}, {5,7}, {11,13},{17,19}

4) Collatz Conjecture Verification for all n between 2 and 20

$n=2, 2 \rightarrow 1$

$n=3, 3 \rightarrow 10 \rightarrow 5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2$ , see  $n=2$  for remainder

$n=4, 4 \rightarrow 2$ , see  $n=2$  for remainder

$n=5, 5 \rightarrow 16 \rightarrow 8 \rightarrow 4$ , see  $n=4$  for remainder

$n=6, 6 \rightarrow 3$ , see  $n=3$  for remainder

$n=7, 7 \rightarrow 22 \rightarrow 11 \rightarrow 34 \rightarrow 17 \rightarrow 52 \rightarrow 26 \rightarrow 13 \rightarrow 40 \rightarrow 20 \rightarrow 10 \rightarrow 5$ , see  $n=5$  for remainder

$n=8, 8 \rightarrow 4$ , see  $n=4$  for remainder

$n=9, 9 \rightarrow 28 \rightarrow 14 \rightarrow 7$ , see  $n=7$  for remainder

$n=10, 10 \rightarrow 5$ , see  $n=5$  for remainder

$n=11, 11 \rightarrow 34 \rightarrow 17 \rightarrow 52 \rightarrow 26 \rightarrow 13 \rightarrow 40 \rightarrow 20 \rightarrow 10$ , see  $n=10$  for remainder

$n=12, 12 \rightarrow 6$ , see  $n=6$  for remainder

$n=13, 13 \rightarrow 40 \rightarrow 20 \rightarrow 10$ , see  $n=10$  for remainder

$n=14, 14 \rightarrow 7$ , see  $n=7$  for remainder

$n=15, 15 \rightarrow 46 \rightarrow 23 \rightarrow 70 \rightarrow 35 \rightarrow 106 \rightarrow 53 \rightarrow 160 \rightarrow 80 \rightarrow 40 \rightarrow 20 \rightarrow 10$ , see  $n=10$  for remainder

$n=16, 16 \rightarrow 8$ , see  $n=8$  for remainder

$n=17, 17 \rightarrow 52 \rightarrow 26 \rightarrow 13$ , see  $n=13$  for remainder

$n=18, 18 \rightarrow 9$ , see  $n=9$  for remainder

$n=19, 19 \rightarrow 58 \rightarrow 29 \rightarrow 88 \rightarrow 44 \rightarrow 22 \rightarrow 11$ , see  $n=11$  for remainder

$n=20, 20 \rightarrow 10$ , see  $n=10$  for remainder