

Name: _____

Math Club: Contest Week Five

Release Date: November 2, 2022

Instructions: Solve the following problem the best you can, first to submit the correct solution via email or the secretaries in Room 332 (with time stamp) wins!

Problem 1. Let $\Phi_1(x) = x - 1$; otherwise, for prime p , let

$$\Phi_p(x) = \sum_{0 \leq k < p} x^k.$$

More generally, for all n

$$\prod_{d \text{ divides } n} \Phi_d(x) = x^n - 1.$$

Compute $\Phi_{30}(2)$.

Hint: it helps to compute any two of $\Phi_6(x)$, $\Phi_{10}(x)$, or $\Phi_{15}(x)$ before computing $\Phi_{30}(x)$.