

Name: \_\_\_\_\_

**Math Club: Contest Week Seven**

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**Release Date:** May 3, 2023

**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.** Prove that  $4^{12345} + 12345^4$  is a composite number.

**Solution.** Note that,

$$(12345^2 + 2(4^{6172}) + 2(12345)(4^{3086}))(12345^2 + 2(4^{6172}) - 2(12345)(4^{3086})) =$$

$$\begin{aligned} &12345^4 + (12345^2)(4^{6173}) - 2(12345^3)(4^{3086}) + 4^{12345} \\ &- (12345)(4^{9259}) + 2(12345^3)(4^{3086}) + (12345)(4^{9259}) - (12345^2)(4^{6173}) = \end{aligned}$$

$$12345^4 + 4^{12345}$$