

# MA $\Theta$ Competition Team Problem Set 9

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**Problem 1.** Find  $3^{31} \pmod{7}$ .

**Problem 2.** Find  $\phi(840)$ .

**Problem 3.** Find  $7^{2025}$  and  $2^{2025} \pmod{100}$ . Note that 2 and 100 are not coprime!

**Problem 4.** If I started making this problem sheet at 4:31 a.m. on Friday and it takes me a googolplex days ( $10^{10^{100}}$ ), on what day of the week will I finish?

**Problem 5.** How many different remainders can result when the 100th power of an integer is divided by 125?

**Problem 6 (Challenge).** Find  $\underbrace{3^{3^{3^{\dots}}}}_{2025 \text{ times}} \pmod{100}$ .