(1) \(N\)-year cicadas breed once every \(N\) years. How often will the breeding year for 17-year cicadas coincide with that of 13-year cicadas?

(2) What is \(14600926_{10}\) in hexadecimal (base 16)?

(3) (a) What is the prime factorization of \(18!\)? (Note, that’s 18 factorial, not just 18.)

(b) What is the smallest positive integer that’s evenly divisible by all integers from 2 to 18?

(4) (a) Write a \textit{closed form} formula (i.e. one with no “\(\cdots\)” or “\(\sum\)”) for \(7 + 14 + 21 + 28 + 35 + \cdots + 7n\).

(b) Prove that your answer is valid.

(5) (a) Prove or disprove that \(4^k - 1\) is evenly divisible by 3 (for all \(k\) where \(k\) is a positive integer).

(b) BONUS: Prove or disprove that \(N^k - 1\) is evenly divisible by \(N - 1\) (for all \(k\) and \(N - 1\) where \(k\) and \(N - 1\) are positive integers).