

Time limit: 15 minutes.

Instructions: This tiebreaker contains 3 short answer questions. All answers must be expressed in simplest form unless specified otherwise. You will submit answers to the problem as you solve them, and may solve problems in any order. You will not be informed whether your answer is correct until the end of the tiebreaker. You may submit multiple times for any of the problems, but **only the last submission for a given problem will be graded**. The participant who correctly answers the most problems wins the tiebreaker, with ties broken by the time of the last correct submission.

No calculators.

1. Consider a rectangular prism with sides of length 2, 4, and 8. Points a and b are opposite corners of the prism, so a and b do not both lie on the same face. Compute the shortest distance between a and b measured along the faces of the prism.
2. Define a string to be a sequence of lower-case letters drawn from the alphabet $\{a, b, h\}$. ϕ is an operator on strings which replaces the first letter of the string according to the following rules, leaving the rest of the string untouched: $a \mapsto ba$, $b \mapsto ah$, $h \mapsto h$. For example, $\phi(bb) = ahb$. Find the string s satisfying $\phi^4(s) = bahaha$.
3. Compute the number of ways to divide 12 indistinguishable slices of pizza among five (distinguishable) people, such that each person receives at least one slice.