

**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 be informed if an answer submission is correct or incorrect upon submission. Resubmissions are allowed, but incorrect submissions incur a penalty if the question is ultimately solved correctly. In addition, to prevent excessive guessing, after making an incorrect submission, you may not make another submission for 30 seconds.

**No calculators.**

1. Compute  $1^2 - 2^2 + 3^2 - \dots - 18^2 + 19^2 - 20^2$ .
2. Reimu and Marisa are playing a game with 2012 coins. Reimu flips all 2012 coins, and then is permitted to flip any subset of the 2012 coins exactly once more. After this, Reimu pays Marisa \$2 for every head on the table, whereas Marisa pays Reimu \$1 for every tail on the table. Who is more likely to earn a profit, and what is the expected profit for that person, in dollars?
3. We define  $n$  to be a squarefree integer if, for every prime  $p$ ,  $p^2$  does not divide  $n$ . Let  $f(n)$  be the sum of the reciprocals of all the divisors of  $n$ . We define  $n$  to be an amazing integer if  $f(n) = 2$ . How many squarefree amazing integers are there?