

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. The quadratic $x^2 - 4x + 2$ has two distinct roots, a and b . Compute the sum of the coefficients of the monic quadratic with roots $a^2 + b^2$ and $a^3 + b^3$.
2. Find the minimum value of $xy + xz + yz$ given that x, y, z are real and $x^2 + y^2 + z^2 = 1$.
3. Find all solutions α with $0^\circ < \alpha < 90^\circ$ to the equation $1 + \sqrt{3} \tan(60^\circ - \alpha) = \frac{1}{\sin \alpha}$.