

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. Let ABC be a triangle with $\angle BAC = 75^\circ$ and $\angle ABC = 45^\circ$. If $BC = \sqrt{3} + 1$, what is the perimeter of $\triangle ABC$?
2. Let $ABCD$ be a square, and let E be a point external to $ABCD$ such that $AE = CE = 9$ and $BE = 8$. Compute the side length of $ABCD$.
3. An ellipse lies in the xy -plane and is tangent to both the x -axis and y -axis. Given that one of the foci is at $(9, 12)$, compute the minimum possible distance between the two foci.