

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. What is the radius of the largest circle centered at $(2, 2)$ that is completely bounded within the parabola $y = x^2 - 4x + 5$?
2. If two points are picked randomly on the perimeter of a square, what is the probability that the distance between those points is less than the side length of the square?
3. In quadrilateral $ABCD$, $CD = 14$, $\angle BAD = 105^\circ$, $\angle ACD = 35^\circ$, and $\angle ACB = 40^\circ$. Let the midpoint of CD be M . Points P and Q lie on \overline{AM} and \overline{BM} , respectively, such that $\angle APB = 40^\circ$ and $\angle AQB = 40^\circ$. PB intersects CD at point R and QA intersects CD at point S . If $CR = 2$, what is the length of SM ?