

Time limit: 15 minutes.

Instructions: This tiebreaker contains 3 short answer questions. All answers on this test are integers. Please enter your answers as integers with no units or other symbols. 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. Isosceles trapezoid $ABCD$ has $AB = 2$, $BC = DA = \sqrt{17}$, and $CD = 4$. Point E lies on \overline{CD} such that \overline{AE} splits $ABCD$ into two polygons of equal area. What is DE ?
2. At the Berkeley Sandwich Parlor, the famous BMT sandwich consists of up to five ingredients between the bread slices. These ingredients can be either bacon, mayo, or tomato, and ingredients of the same type are indistinguishable. If there must be at least one of each ingredient in the sandwich, and the order in which the ingredients are placed in the sandwich matters, how many possible ways are there to prepare a BMT sandwich?
3. Three mutually externally tangent circles have radii 2, 3, and 3. A fourth circle, distinct from the other three circles, is tangent to all three other circles. The sum of all possible radii of the fourth circle can be expressed as $\frac{m}{n}$, where m and n are relatively prime positive integers. Compute $m + n$.