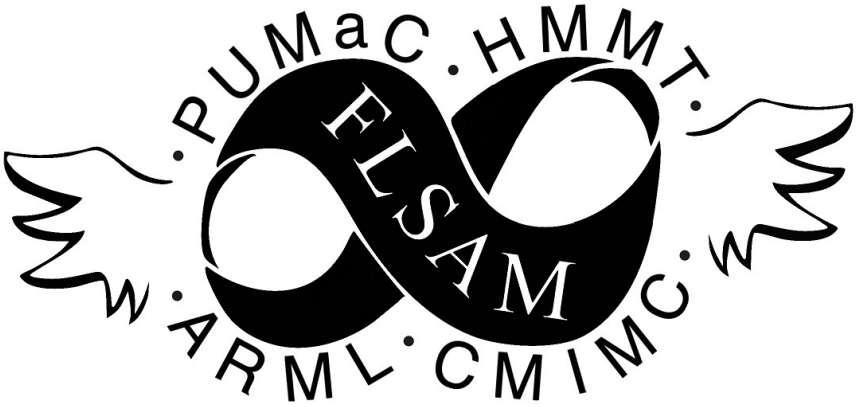
Florida Student Association of Mathematics



2023-2024 HMMT/CMIMC Tryout

December 16-17, 2023

Round 2: Geometry

1. What is the sum of all possible values of the number of intersections between a circle of radius 3 and an $8-15-17$ right triangle?

2. Let $ABCD$ be a parallelogram with $\angle A > 90^\circ$. If the angle bisector of $\angle ABC$ bisects $\overline{AD}$ and $AB = 20$, find the number of possible integer values of length BD.

3. Externally tangent circles ω_1, ω_2, each with radius 1, are inscribed in equiangular hexagon $ABCDEF$ such that ω_1 is tangent to EF, FA, AB and ω_2 is tangent to AB, BC, CD. Suppose that $AB = CD = EF$ and $BC = DE = AF$. Given that the area of $ABCDEF = a + b\sqrt{c}$ for positive integers a, b, c, where c is not divisible by the square of any prime, find $a^2 + b^2 + c^2$.

4. Let $ABCD$ be an isosceles trapezoid with $AB \parallel CD$, and let $E = \overline{AC} \cap \overline{BD}$. If $AB = 7$, $CD = 8$, and $\odot(CDE)$ bisects $\overline{AD}$, what is the perimeter of $ABCD$?

5. Consider rhombi $PQAB$ and $PQCD$ where $\overline{AB}, \overline{CD}$ are on opposite sides of PQ. If $PQ = 40$, $AD = 39$, and the total area of the two rhombi is maximized, find BC.

6. Cyclic pentagon $ABCDE$ has $AB \parallel DE$. The line through C parallel to AB intersects BD at F. Given $AB = 11$, $BD = 20$, $DE = 13$, and $\frac{BC}{CE} = \frac{1}{2}$, $\frac{BF}{FD} = \frac{m}{n}$ in simplest terms. Find $m + n$.