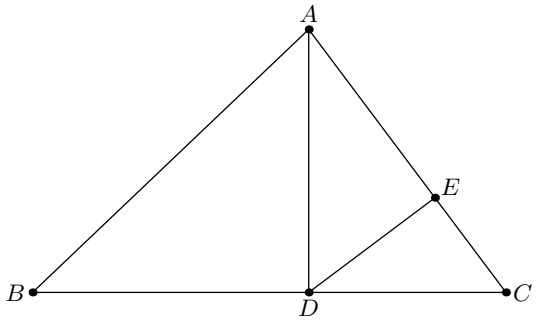
2024 SSMO Relay Round 1

SMO Team

RR 1 Part 1: Let AD be an altitude of triangle ABC and let DE be an altitude of triangle ACD. If $AB = 29, CE = 9$, and $DE = 12$, what is the area of triangle ABC?



RR 1 Part 2: Let $T = TNYWR$. A circular necklace is called *interesting* if it has T black beads and T white beads. A move consists of cutting out a segment of consecutive beads and reattaching it in reverse. It is possible to change any *interesting* necklace into any other *interesting* necklace using at most x moves. Find x. (Note: Rotations and reflections of a necklace are considered the same necklace).

RR 1 Part 3: Let $T = TNYWR$. In a circle, there are T people. $T - 2$ of them have red shoes, and two of them have blue shoes. First, they will randomly eliminate somebody from the circle. Then, they will randomly eliminate somebody with red shoes from the circle, and the cycle repeats until there is only one person left. If the probability this person has blue shoes is $\frac{m}{n}$, for relatively prime positive integers m and n, find $m + n$.