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 ω be a circle with radius 1. Equilateral triangle $\triangle ABC$ is tangent to ω at the midpoint of side BC and ω lies outside $\triangle ABC$. If line AB is tangent to ω, compute the side length of $\triangle ABC$.

2. Triangle $\triangle ABC$ has side lengths $AB = 3, AC = 2$ and angle $\angle CBA = 30^\circ$. Let the possible lengths of BC be l_1 and l_2, where $l_2 > l_1$. Compute $\frac{l_2}{l_1}$.

3. Triangle $\triangle ABC$ has side lengths $AB = 5, BC = 8$, and $CA = 7$. Let the perpendicular bisector of BC intersect the circumcircle of $\triangle ABC$ at point D on minor arc BC and point E on minor arc AC, and AC at point F. The line parallel to BC passing through F intersects AD at point G and CE at point H. Compute $\frac{[CHF]}{[DGF]}$. (Given a triangle $\triangle ABC$, $[ABC]$ denotes its area.)