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A Sangaku-type problem with regular polygons, triangles, and congruent incircles.

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The following Sangaku problem dates back to 1886: Let ABC be an equilateral triangle. The side AC is extended to the point B' , the side BA is extended to C' , and CB to A' , such that the triangles $AB'C'$, $BC'A'$, $CA'B'$ and ABC have congruent incircles. Find the length of the exterior equilateral triangle $A'B'$ in terms of the length of AB . In this paper this problem is extended to consider regular polygons of arbitrary number of sides. Namely the sides of a regular n -sided polygon are extended in such a way that the incircles of the new five triangles appearing after the construction are congruent to the incircle of the original polygon. Then, the side of the bigger n -sided polygon is computed in terms of the side of the original one. It is a nice generalization, the proof is elementary and the paper is worth reading even in the undergraduate level.

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<http://forumgeom.fau.edu/FG2013volume13/FG201319index.html>