Hidden Secrets in Cevian Triangles

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Purpose of the Project The triangle is the most common term in geometry studies. Therefore, it is hard to believe anyone can discover new facts about this extensively studied subject. The primary goal of my study was to expand the knowledge about symmedians and deepen the understanding of them. The secondary goal was to research and analyze cevian triangles of special triangle centers. The final goal was to find and develop methods for solving geometric problems using tools from different fields in mathematics. Procedures Used I proved series of theorems using tools from different fields in mathematics such as calculus, algebra, functional equations and computer programing. I rose hypothesizes and tested their feasibility. Results and conclusions I proved the following theorems: 1. Two triangles are congruent if and only if their symmedians are equal in length respectively. 2. Given three symmedians the triangle doesn't always exist. I found the range of values in which the triangle does exist. 3. Given three symmedians, the triangle may not be constructible with a compass and a straightedge. 4. The original cevian triangle isn't necessarily isosceles when the cevian triangle of the symmedian point is isosceles. I found the range of values in which the original triangle is isosceles and investigated this problem for the cevian triangles of the Nagel, Brocard, Gergonne, and incenter points. In addition, I a revealed a new proof for the existence of a triangle with prescribed angle bisector lengths theorem.