Reflection:
How Math Competition Experiences
Influenced My Math Research

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During my high school years, our math teacher encouraged us to write short papers on mathematical topics of our choice. I vividly recall some fascinating papers written by my classmates; one delved into optimizing the costs of bus rides based on pricing policies, while another explored the mathematical curves created by insects as they consumed tree leaves. As someone deeply involved in various math competitions, my articles often centered on the intricate problem-solving techniques found in these contests.

One memorable experience occurred when I encountered Eisenstein's Criterion for irreducible polynomials in my studies, only to find that the textbook lacked a proof. Determined to fill this gap, I developed my proof and crafted an article around it. This experience sparked a deeper reflection on how math competition problems require creative thinking and innovative approaches, leading me to write more in-depth essays on the thinking processes behind solving new and challenging problems. My math teacher found these essays enjoyable and even recommended some for publication in high school mathematics journals.

While these articles did not constitute formal "research," they highlighted math competitions as transformative experiences that shaped my mathematical approach and influenced my future research. Competitions nurtured in me a profound appreciation for problem-solving, exposing me to challenging and unconventional problems and instilling in me a sense of curiosity and a readiness to tackle complex problems head-on – essential qualities for meaningful research.

The distinction between math competitions and research is significant. A math competition problem, no matter how challenging, is known to have a solution. In contrast, research involves working on problems that may not have solutions, potentially leading to years spent on a problem only to discover it was approached incorrectly. My Ph.D. advisor once shared with me his approach to finding research topics: "Suppose you come up with one hundred ideas for research topics, and one of them works, then you are very productive!" There were instances

where I spent weeks trying to solve a problem, only to find a small, obscure bug in my numerical analysis code. Major breakthroughs in my research often came after intense, sleepless nights grappling with these problems.

The knowledge and skills acquired through math competition preparation are invaluable and can offer great insights in research. For instance, the Cauchy-Schwarz Inequality, typically studied in its discrete form for math competitions, finds applications in various fields such as linear algebra, real and complex analysis, partial differential equations, and finite element analysis. We even coined a term for its application in research projects: "Schwarz it." Moreover, years of math competition training taught me to approach problems from unconventional angles, quickly grasp key ideas, and find paths to potential solutions.

Additionally, math competitions provide an excellent opportunity for networking and collaboration. Over the years, I have met and interacted with many talented individuals who share my passion for mathematics, leading to collaborations, partnerships in research, and lifelong friendships.

In conclusion, my experiences in math competitions have profoundly influenced my approach to mathematics and research endeavors. By fostering problem-solving skills, critical thinking, perseverance, and collaboration, math competitions have provided me with a solid foundation for success in the world of mathematical research.