Research Experience & Interests
Mattie H Ji

I am interested in Professor Lena Ji's project on algebraic varieties because it perfectly aligns with my interests in pursuing research in algebra.

Out of all my classes at Brown University, I feel most interested in algebra because I find the subject itself extremely beautiful. Last fall, I took a first semester graduate algebra course, based on selected contents from Aluffi's *Algebra: Chapter 0* and Morandi's *Field and Galois Theory*. My favorite part of the course was on infinite Galois theory where we covered the Krull topology on Galois groups and Artin-Schreier extensions. There was an exercise I solved that was particularly memorable. It first introduced me to the definition an inverse limit of discrete finite groups, ie. a profinite group, then it asked to prove that this profinite group corresponds exactly to a Galois group equipped with the Krull topology. This was really surprising to me, and I am extremely fond of this type of serendipity of connections that occur all over algebra.

I am also enamoured by how algebra applies seamlessly in other fields of mathematics. In my Topology class last semester, I completed a final project on using Van Kampen's Theorem to prove the Wirtinger presentation. In my Topology class, the theorem was quite confusing since the instructor refrained from discussing free groups and group presentations. But in my project, I managed to package the Van Kampen Theorem into the language of Free Product with Amalgamations, and suddenly everything about the theorem made sense. It turns out that my coursework in Graduate Algebra I was especially helpful over the process, and I particularly enjoy how algebra can simplify many results in other fields.

This semester, I am taking a course in commutative algebra based on Atiyah and MacDonald's *Introduction to Commutative Algebra* and a course in algebraic number theory based on Tall and Stewart's *Algebraic Number Theory and Fermat's Last Theorem*. I am also participating in a directed reading program in category theory based on Riehl's *Category Theory in Context*. With these studies, I hope to gain a deeper understanding of algebra and how it relates to other fields, and I would love to have the opportunity to conduct research on this subject too!

I am particularly excited about Professor Lena Ji's project on algebraic varieties. When I first learned Galois theory, I found how it relates polynomials and fields and groups simply beautiful. In addition, I am also planning on pursuing further courseworks in algebraic geometry my Junior year. Therefore, this project would be the perfect synthesis of my two interests in Algebra. In addition, thanks to the guidance for applying to REUs she provided on her website, I think I had an easier time and more clearance on writing this application than I otherwise would have.

Overall, I would be delighted to be able to further my understanding and interests of algebra at UMich's Mathematics REU this summer!