Under the supervision of Professor Vasily Dolgushev, I conducted the research that introduced a more streamlined version of the groupoid GTSh of GT-shadows and contributed to the SageMath package for working with GT-shadows. The groupoid GTSh is a 'computable' approximation to the gentle version of the Grothendieck–Teichmüller group  $\widetilde{GTSh}$  is the poset  $\widetilde{GTSh}$  is the poset  $\widetilde{GTSh}$  of  $\widetilde{GTSh}$  is the poset  $\widetilde{GTSh}$  of  $\widetilde{GTSh}$  invariant finite index normal subgroups of the free group  $F_2$  on two generators. This object is worth studying because it is very 'likely' that in most cases, the element of GTSh lifts to the absolute Galois group. And it is already known that for dihedral posets, every element of GTSh lifts to the absolute Galois group.

Mentored by Professor Maxence Mayrand, I participated in a research internship that constructed new GKP code from the Abelian varieties on the cyclotomic field  $K = \mathbb{Q}(\zeta_n)$ . The construction  $(K \otimes_{\mathbb{Q}} \mathbb{R})/\mathcal{O}_K$  is an abelian variety of CM-type. We defined a skew-symmetric form E and extended it to a hermitian inner product E on E on E on the extended it to a hermitian inner product E on E

Under the supervision of Professor Lisa Berger, Ajmain Yamin and Connor Stewart, I participated in an online collaborative research to obtain equations for  $K_9$  dessin, that is the bipartification dessin of the complete regular map from  $K_9$  graph. We proved that the Riemann surface of the  $K_9$  dessin is a degree 9 cover of the Bolza surface  $y^2 = x(x^4 - 1)$  with covering group  $(\mathbb{Z}/3\mathbb{Z})^2$ . We used the fact that any unramified abelian cover of a Riemann surface S is obtained from pulling back S along an unramified abelian cover of the Jacobian Jac(S) of S. So, we computed the equation for the Abel-Jacobi map of the Bolza surface  $S_B$  and constructed a degree 9 cover of the Jacobian Jac( $S_B$ ) and obtained the equation.

These research experiences let me explore a wide range of mathematics and significantly improve my self-learning, writing, programming and speaking skills. It is these research experiences that boost my determination to seek admission to a graduate program and do mathematical research.