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Introduction to tropical curve counting

Abstract: The main goal of this minicourse is to introduce students to enumerative applications of tropical geometry. Tropical geometry is a combinatorialization of ordinary geometry. By either doing algebraic geometry over the tropical semi-field or over fields with a valuation, one may associate piecewise linear objects to ordinary algebraic varieties. Remarkably such highly degenerate objects retain a lot of geometric information about the original algebraic varieties. For example, the notion of dimension is preserved: thus to an algebraic curve is associated a graph. Further, the genus of the curve generically is equal to the genus of the graph. In the last twenty-some years many groups of researchers have explored these connections, providing a wealth of correspondence theorems: statements on how to recover classical information from its tropical counterpart. In this minicourse we will focus in particular on a celebrated result of Mikhalkin, which shows that the count of rational tropical plane curves of degree d through 3d – 1 points in general position equals the classical count. Time permitting we will show some further applications of tropical techniques to Hurwitz theory, the count of ramified covers of Riemann Surfaces.

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