Benjamin Ribovich

Tangent and Secant Spaces

The purpose of this research was to explore the relationship between graphs in the xy-plane and their respective secant spaces, or the space constituting the graph's set of secant lines plotted as y-intercept versus slope (in the mb-plane). Using analytical as well as numerical methods to construct the secant space of functions, geometric shapes, and conic sections, two major connections were found between graphs and their secant spaces. First, for continuous graphs the secant space is equal to an open region whose boundary is the original graph's tangent lines plotted in the mb-plane (the tangent space). The tangent space has the additional property that, when applied to a given curve four times, the original curve is produced. This result provides insight and alternative proofs for two theorems presented in a recent paper "Reconstructing a Function from its Set of Tangent Lines" by Professor Alan Horwitz. Secondly, the tangent space was consistently constituted by the cross section of the original graph extended into three dimensions, a property that was developed further for conic sections. This analysis led to the conjecture that the tangent space of any given conic section is another conic section in the mb-plane.