Hamilton Hardison

Geometrically Exploring Trigonometric Functions

In this activity students will explore the properties of the trigonometric functions in a unique way. The Unit Circle tab contains a sketch that shows the magnitudes of the trigonometric functions in terms of triangle side lengths. Using this sketch as a starting point, we will examine some of the properties of the trigonometric functions, including the domain and range of each function.

Students will be introduced to an idea we will call signed domain. The signed domain has two components: positive and negative. The positive domain is all of the angle values that produce a positive value for a trigonometric function. Similarly, the negative domain is all of the angle values that produce a negative value for a trigonometric function. Since lengths are positive definite, I have associated the color red with positive values and the color blue with negative values. This will allow students to explore both the magnitude and sign of the trigonometric functions in a geometric construction.

There is a tab in the sketch for each trigonometric function. The appropriate segments have been selected to be traced using signed coloring. By dragging or animating a point A, students will be presented with nice visual representations of the sign changes associated with the trig. functions (these are much more appealing than “All students take calculus”.) This will allow students to dynamically investigate the domain of the function in terms of angle measure and the range of the function in terms of lengths. By investigating areas where the traces change colors, students can discover zeros and vertical asymptotes of trigonometric graphs by thinking critically without being handed a graphing calculator. This activity will serve as a bridge from thinking about trigonometric relationships geometrically, as ratios and constructions based on constructions on the unit circle, to thinking about trigonometric relationships as functions.