**Ambiguous Case of the Law of Sines**

*Description*: This activities introduces the ambiguous case of the Law of Sines through exploration of the unit circle and the range of inverse trig functions.

**Possible Learning Objectives**

* MA 204.6 Solve Oblique Triangles

**Activity Objectives**

The students working on this activity will work towards understanding:

* How the restricted domain of sine influences calculator output values and how to interpret the various cases.
* How the restricted domain of sine intersects with the interval of possible measurements of angle values.

**Prior Knowledge Assumed**

Before completing this activity, students should have encountered or mastered the following:

* The Law of Sines formula
* Inverse Trig functions and restricted domains
* Range of sine functions

**Learning Outcomes**

* *Measurable Outcomes*
  + Students will use the Law of Sines to solve oblique triangles.
  + Students will identify how many triangles can be solved with the given information.
* *Extensions*
  + Describe the necessary conditions that “trigger” the ambiguous case.

**Elements of Mathematical Inquiry**

* *Active Learning*

The students will want to think there is a single correct solution resulting from the Law of Sines and their calculator work. The typical connection between the sum of angles in a triangle and the second quadrant producing positive sine values escapes them upon their first attempts. The available picture is intentionally to scale so that the students can recognize the obtuse angle contradicting their acute answer. The ambiguous case is traditionally problematic because they have difficulty characterizing the sine function. The scaffolding of the problem takes care of much of the selection process, leaving the students to perform and evaluate the scaffolded tasks.

* *Meaningful Applications*

Students are asked to identify the relationship between the solution produced by a calculator and the possible angles derived from the unit circle; this allows them to distinguish when a triangle has one solution or two solutions. Throughout, students are also asked to make and justify observations in a scaffolded way, with the intention of solidifying the “why” of the ambiguous case of the Law of Sines. This interrogative process can then be generalized to contexts of similar complexity, reducing student cognitive load when dealing with these problems.

* *Academic Success Skills*

This activity was written for a course design which is predominantly done working in groups. When the students are given the opportunity to bounce ideas off each other, they will feel more comfortable with the material, reducing math anxiety. Additionally, they may feel more comfortable with productively struggling through problematic content.

**Recommended Technologies**

Students should have a scientific calculator that can compute inverse trig values.