# The Ambiguous Case of the Sine Law with TI-Nspire  Teacher Guide
## Algebra II or Trigonometry

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**Activity Overview**
Students will determine the number of solutions by using the Ambiguous Law of Sines, given SAS.

**TN State Standard**
CLE 3103.4.4 Know and use the Law of Sines to find missing sides and angles of a triangle, including the ambiguous case. *(Level 3 on Webbs Depth of Knowledge)*

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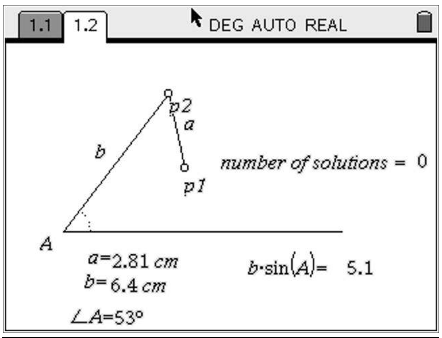
1. Given: $\sin(A) = \dfrac{opposite}{hypotenuse}$

   Explain how $\sin(A) = \dfrac{opposite}{hypotenuse}$ is equivalent to: hypotenuse * sine(A) = opposite?

   Ans. May vary. *Isolate opposite. Multiply by both sides by the hypotenuse. Therefore, hypotenuse cancels out on the right side leaving the equivalent equation above.*______

2. **Formula for Ambiguous Law of Sines**
   If **b** is the hypotenuse and **a** is the opposite side then
   hypotenuse * sin(A) = opposite becomes
   _________ * sin(A) = _______ when we have a
   . RIGHT triangle. But what if it is not?




   - **Open the TI-Nspire document *Ambiguous_Law_of_Sines*.**
     - **Use** ctrl ❸ to page down.
   - **Press** ctrl ▶ (right side of NavPad) **to move to page 1.2 and begin the lesson**

3. **Complete** the table below.

| (To grab, ctrl ) Move point p1 around to get the following cases: | • How many triangle(s) can you form, if any?<br>• Describe what type of triangle(s) is/are formed, if any. | Number of solutions |
|---|---|---|
| a < b*sin(A) | *No triangles can be formed because the length of a is not long enough to form a triangle.* | *0 solutions* |
| a = b*sin(A) | *One triangle is formed. A right triangle is formed by side a.* | *1 solution* |
| a > b*sin(A) and a < b | *Two triangles are formed. Side a forms one obtuse and one acute with base side.* | *2 solutions* |
| a > b*sin(A) and a > b | *Only one triangle can be formed. An obtuse triangle is formed by side a.* | *1 solution* |

4. From the chart above, write a conjecture between the number of triangles created, if any, and the number of solutions.
   *The number of solutions is dependent on the length of the side opposite the given angle and by how many triangles can be created.*

5. Place point p1 where the number of solutions equal 1. What do you notice about the length of a and b*sin(A)? *Side a is equal to b*sin(A)*

6. Place point p1 where a = 5.5cm. Is it possible for p1 to equal 5.5cm and the number of solutions equal 2? Explain.
   *Yes it is possible to have two solutions because two triangles can be created when the length of side a equals 5.5cm.*

7. **Grab** Point p2. Move point p2 so angle A is an obtuse angle. How many triangles can you make now? Explain.
   *No more than one triangle* because side a will always be longer than side b. Hence form the table, when a > b*sin(A) and a > b, *only one triangle can be formed with an obtuse angle.*

8. ***Formative Assessment – Exit Slip (provide each student with a note card):***

In each of the following, find the number of solutions. Explain.

a) Angle $A = 45°$, $a = \sqrt{2}$, $b = 2$.

   Therefore, $b \sin A = 2\sqrt{2}/2 = \sqrt{2}$, which is equal to $a$. There is therefore one solution: angle $B$ is a right angle.

b) Angle $A = 45°$, $a = 1.8$, $b = 2$.

   Again, $a < b$. $b \sin A = 2\sqrt{2}/2 = \sqrt{2}$, which is less than $a$. Therefore there are two solutions.

c) Angle $A = 45°$, $a = 2$, $b = 1.5$.

   Here, $a > b$. Therefore there is one solution.

d) Angle $A = 45°$, $a = 1.4$, $b = 2$.

   $a < b$. $b \sin A = 2\sqrt{2}/2 = \sqrt{2}$, which is greater than $a$. Therefore there are no solutions.