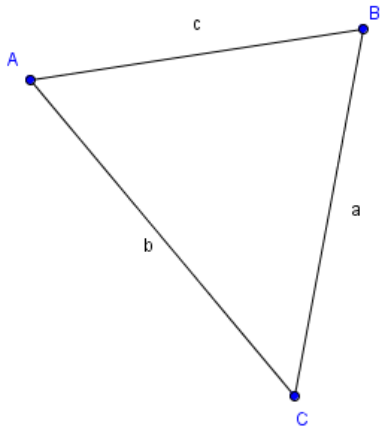
Investigation: The Laws of Sines and Cosines

Algebra 2

We have been looking at how we can use trigonometric ratios (sin, cos, tan) to find missing parts of *right triangles*. In this investigation you will explore the two rules that will help us to find missing parts of *any* triangle, even if it is not a right triangle.

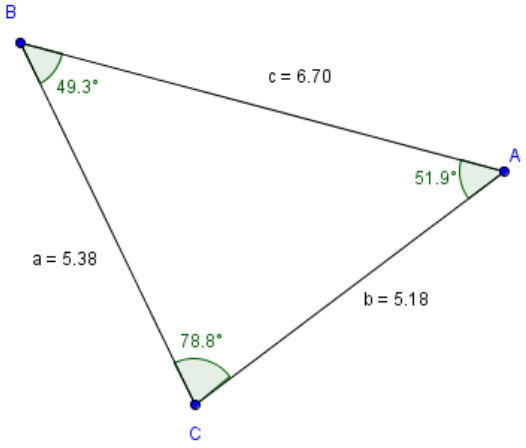
I. Set up the sketch.
   A. Open GeoGebra
   B. Hide the Axes and hide the "Algebra View" (both of these are under the View menu).
   C. In the Options menu, choose Labeling | **All New Objects**
   D. Use the point  and segment  tools to create a triangle.
   E. **Important:** rename the parts of your triangle so that
      - Side *a* is opposite angle *A*.
      - Side *b* is opposite angle *B*.
      - Side *c* is opposite angle *C*.

      (*See diagram at right.*)



II. Take measurements
   A. Use the measure tool  to measure all three angles.

      Make sure the measurements are *inside* the triangle.
   B. Click the small arrow on the measure tool and select  Distance or Length.
   C. Measure all three sides of the triangle.
   D. On each side of the triangle, do this:
      i. Right-click the side of the triangle and choose Object Properties...
      ii. Where it says, Show Label choose "Name & Value."
   E. Your triangle should now look something like this:



III. Explore
   A. Drag the three vertices of the triangle to create a random triangle.
   B. Fill in the table below for the values you see on your screen.
   C. Repeat this with 4 different triangles.

IV. Questions
   A. Explain how this table verifies that the Law of Sines works.

   B. Explain how this table verifies the Law of Cosines.

	Triangle 1	Triangle 2	Triangle 3	Triangle 4
a				
b				
c				
A				
B				
C				
$\sin A$				
$\sin B$				
$\sin C$				
$\frac{a}{\sin A}$				
$\frac{b}{\sin B}$				
$\frac{c}{\sin C}$				
a^2+b^2				
$2\,a\,b\cdot\cos(C)$				
$a^2+b^2-2\,a\,b\cdot\cos(C)$				
c^2				