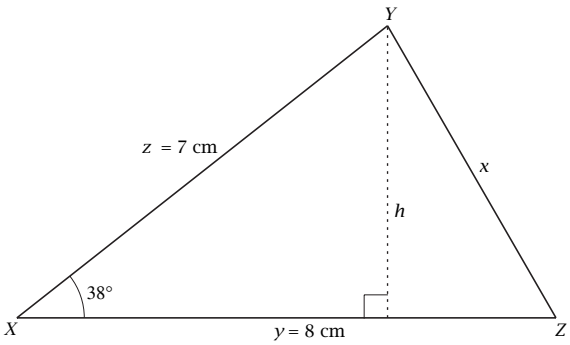
Name: _____ Group Members: _____

# Exploration 6-3a: Area of a Triangle and Hero's Formula

Date: _____

**Objective:** Derive a *quick* method to calculate the area of a triangle from two sides and the included angle.

For Problems 1–3, $\triangle XYZ$ has sides $y = 8$ cm, $z = 7$ cm, and included angle $X = 38°$.




1. Do you agree with the given measurements?

   $y$ _____ $z$ _____ $\angle X$ _____

2. Use the given measurements to calculate altitude $h$. Measure $h$. Does it agree with the calculation?

3. You recall from geometry that the area of a triangle is $\frac{1}{2}$(base)(altitude). Find the area of $\triangle XYZ$.

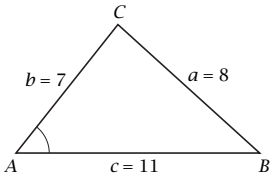
4. By substituting $z \sin X$ in Problem 3 you get

   Area $= \frac{1}{2}yz \sin X$, or, in general,

   Area $= \frac{1}{2}$(side)(side)(sine of included angle).

   Sketch a triangle with sides 43 m and 51 m, and included angle 143°. Use this area formula to find the area of this triangle.

For Problems 5–8, $\triangle ABC$ has sides $a = 8$, $b = 7$, and $c = 11$.




5. Find the measure of angle $A$ using the law of cosines. Store the answer without rounding.

6. Use the unrounded value of $A$ and the area formula of Problem 3 to find the area of $\triangle ABC$.

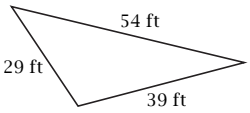
7. Calculate the **semiperimeter** (half the perimeter) of the triangle, $s = \frac{1}{2}(a + b + c)$.

8. Evaluate the quantity $\sqrt{s(s-a)(s-b)(s-c)}$. What interesting thing do you notice about the answer?

9. Use **Hero's formula,** namely,

   Area $= \sqrt{s(s-a)(s-b)(s-c)}$

   to find the area of this triangle.




10. What did you learn as a result of doing this Exploration that you did not know before?