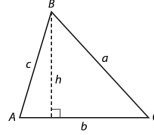## 4-3 Law of Sines

⊘ Explore **Use an Area Formula to Derive the Law of Sines**
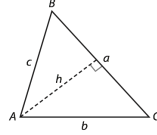
Recall that the area of a triangle can be found using the sine of one of the angles.

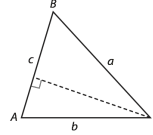Area $= \frac{1}{2} b \cdot c \cdot \sin(A)$

You can write variations of this formula using different angles and sides from the same triangle.

(A) Rewrite the area formula using side length a as the base of the triangle and $\angle C$.

(B) Rewrite the area formula using side length c as the base of the triangle and $\angle B$.

(C) What do all three formulas have in common?

(D) Why is this statement true?

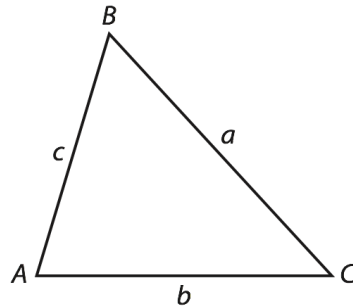$\frac{1}{2} b \cdot c \cdot \sin(A) = \frac{1}{2} a \cdot b \cdot \sin(C) = \frac{1}{2} c \cdot a \cdot \sin(B)$

(E) Multiply each area by the expression $\frac{2}{abc}$. Write an equivalent statement.
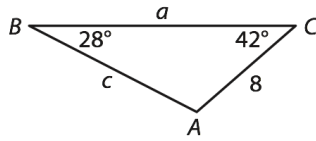
Law of Sines

Law of Sines

Given: $\triangle ABC$

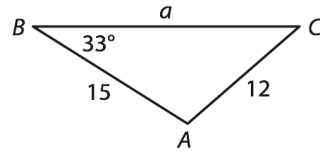$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$

Find all the unknown measures using the given triangle. Round to the nearest tenth.
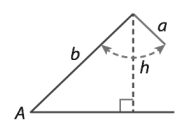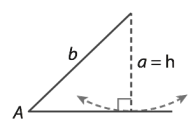
4.

5.

Solve the triangle given:
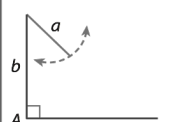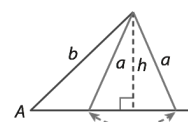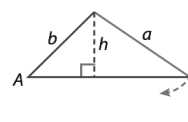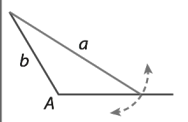
$A = 76.7°$

$B = 29.3°$

$c = 87$

⚙ Explain 2 **Evaluating Triangles When SSA is Known Information**

When you use the Law of Sines to solve a triangle for which you know side-side-angle (SSA) information, zero, one, or two triangles may be possible. For this reason, SSA is called the ambiguous case.

Ambiguous Case

Given a, b, and m$\angle A$.

∠A is acute.		∠A is right or obtuse.
$a < h$ No triangle	$a = h$ One triangle	$a \leq b$ No triangle
$h < a < b$ Two triangles	$a \geq b$ One triangle	$a > b$ One triangle

Solve the triangle ABC.
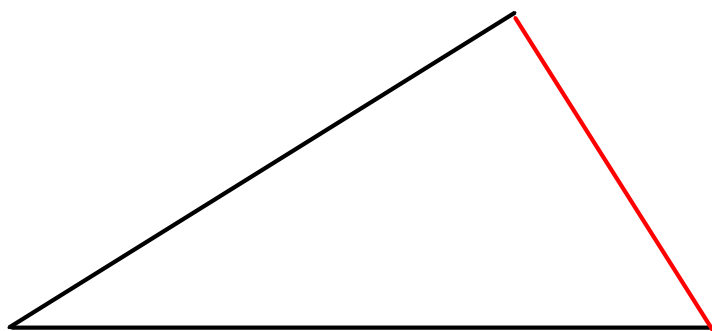### Given a=20, b=5, B=42°

Solve the triangle ABC.
Given: a=3, b=2, A=40º

Solve the triangle ABC.
Given: a=6, b=8, A=35º

Solve the triangle ABC.

Given: a=37, b=40, A=71°