Section: 4.7 Law of Sines

Objective: SWBAT find measures of all angles and side lengths of any triangle.
We learned to solve right triangles in chapter 4. We will start this chapter by learning to solve oblique triangles (non-right triangles).

Please note that angles are Capital letters and the side opposite is the same letter in lower case.
What we already know

• The interior angles total 180°.
• We can’t use the Pythagorean Theorem. Why not? **NO Rt. Angle**
• For later, area = ½ bh
Playing with the triangle

Let’s drop an altitude and call it $h$.

If we think of $h$ as being opposite to both A and B, then

$$\sin A = \frac{h}{b} \quad \text{and} \quad \sin B = \frac{h}{a}$$

Let’s solve both for $h$.

$$b \sin A = a \sin B$$

This means

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$
If I were to drop an altitude to side $a$, I could come up with

$$\frac{\sin B}{b} = \frac{\sin C}{c}$$

Putting it all together gives us the Law of Sines.

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

You can also use it upside-down.

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
Objective: SWBAT find measures of all angles and side lengths of any triangle.

**LAW OF SINES**

Non-Right Triangles (Oblique)

If $ABC$ is a triangle with sides $a$, $b$, and $c$, then:

\[
\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}
\]
What good is it?

The Law of Sines can be used to solve the following types of oblique triangles

- Triangles with 2 known angles and 1 side (AAS or ASA)
- Triangles with 2 known sides and 1 angle opposite one of the sides (SSA)

With these types of triangles, you will almost always have enough information/data to fill out one of the fractions.

\[
\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}
\]
General Process

1. Except for the ASA triangle, you will always have enough information for 1 full fraction and half of another. Start with that to find a fourth piece of data.

2. Once you know 2 angles, you can subtract from 180 to find the 3\textsuperscript{rd}.

3. To avoid rounding error, use given data instead of computed data whenever possible.
Example 1:

Law of Sines works quickly whenever you are given two angles and a side. (AAS or ASA)

Use the given information to solve the triangle.

Ex. 1 \[ C = 102.3^\circ, \ B = 28.7^\circ, \text{ and } b = 27.4 \]

\[ \frac{\sin 28.7^\circ}{27.4} = \frac{\sin 102.3^\circ}{c} \]

\[ c \sin 28.7^\circ = 27.4 \sin 102.3^\circ \]

\[ \frac{c \sin 28.7^\circ}{\sin 28.7^\circ} = \frac{27.4 \sin 49^\circ}{\sin 28.7^\circ} \]

\[ c = \frac{55.75}{\sin 28.7^\circ} \]

\[ a = \frac{27.4 \sin 49^\circ}{\sin 28.7^\circ} = 43.1 \]
Example 2:

Law of Sines works quickly whenever you are given two angles and a side. (AAS or ASA)

Use the given information to solve the triangle.

Ex. 2 Let $A = 35^\circ$, $B = 10^\circ$, and $c = 45$

\[
\begin{align*}
\sin 135^\circ &= \frac{45}{b} \\
45 \cdot \sin 135^\circ &= b \cdot \sin 135^\circ \\
b &= \frac{45 \cdot \sin 135^\circ}{\sin 135^\circ} \\
b &= 11.05
\end{align*}
\]
With ONE partner....

Turn your book to page 291 and complete “Guided Practice” number 1A.
Math pick up lines!

Hey baby! What's your sine?
Law of Sines

Topic 2

“A Pain in the @SS!”
Example 3 SSA

Let \( A = 40^\circ \), \( b = 10 \), and \( a = 7 \)

\[
\frac{\sin 40^\circ}{7} = \frac{\sin B}{10}
\]

\[
10 \sin 40^\circ = 7 \sin B
\]

\[
\sin B = \frac{10 \sin 40^\circ}{7}
\]

\[
\sin^{-1} \left( \frac{10 \sin 40^\circ}{7} \right) = B
\]

\( B = 66.7^\circ \)

\[
\angle C = 73.3^\circ
\]

\[
\frac{\sin 40^\circ}{7} = \frac{\sin 73.3^\circ}{c}
\]

\[
\angle C \sin 40^\circ = 7 \sin 73.3^\circ
\]

\[
\sin 40^\circ = 7 \cdot \frac{\sin 73.3^\circ}{c}
\]

\[
c = 10.41
\]
With ONE partner....

Turn your book to page 293 and complete “Guided Practice” number 3B.
Why should you use given data whenever possible?

$$\sin^{-1} \ SSA$$

Worksheet #’s 1, 2, 3, 4, 7, 8

Unit Circle Quiz!!