Section 8-5 : Law of Sines

A rescue boat spots a lost hiker on the edge of a rock shelf. How far is the boat from the hiker?

**Key Concept** Law of Sines

For any $\triangle ABC$, let the lengths of the sides opposite angles $A$, $B$, and $C$ be $a$, $b$, and $c$, respectively. Then the Law of Sines relates the sine of each angle to the length of the opposite side.

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$
Ex 1) Using the Law of Sines (AAS)

In \( \triangle ABC \), \( m \angle A = 48 \), \( m \angle B = 93 \), and \( AC = 15 \). To the nearest tenth, what is the length of \( BC \)?

\[
\frac{\sin 93}{15} = \frac{\sin 48}{x}
\]

\[
x \cdot \sin 93 = 15 \cdot \sin 48
\]

\[
x = \frac{15 \cdot \sin 48}{\sin 93}
\]

\[
x = 11.2
\]

You try)

In \( \triangle ABC \), what is \( AB \) to the nearest tenth?

\[
\frac{\sin 93}{15} = \frac{\sin 39}{x}
\]

\[
x \cdot \sin 93 = 15 \cdot \sin 39
\]

\[
x = \frac{15 \cdot \sin 39}{\sin 93}
\]

\[
x = 9.5
\]
Ex 2) Using Law of Sines

In \( \triangle RST \), \( RT = 11 \), \( ST = 18 \), and \( m\angle R = 120^\circ \). To the nearest tenth, what is \( m\angle S \)?

\[
\frac{\sin 120}{18} = \frac{\sin x}{11}
\]

\[
11 \cdot \sin 120 = 18 \cdot \sin x
\]

\[
\frac{11 \cdot \sin 120}{18} = \sin x
\]

\[
\sin^{-1}(0.52923) = x
\]

\[
x = 32^\circ
\]

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From 8-5 HW

1.

\[
\frac{\sin 40}{8.5} = \frac{\sin 70}{x}
\]

\[
x \cdot \sin 40 = 8.5 \sin 70
\]

\[
x \cdot \frac{8.5 \sin 70}{\sin 40} = \sin 40
\]

\[
x = 12.4
\]
10. \[ \frac{\sin 32}{17} = \frac{\sin x}{13} \]
\[ 13 \cdot \sin 32 = 17 \cdot \sin x \]
\[ 0.40523 = \sin x \]
\[ \sin^{-1}(0.40523) = x \]
\[ x = 23.9 \Rightarrow x = 24 \]

\[ \frac{\sin 32}{17} = \frac{\sin 124}{y} \]
\[ 4 \cdot \sin 32 = 17 \cdot \sin 124 \]
\[ \frac{y \cdot \sin 32}{\sin 32} = \frac{17 \cdot \sin 124}{\sin 32} \]
\[ y = 26.6 \]

**you try**

In \( \triangle KLM \), \( LM = 9 \), \( KM = 14 \), and \( \angle L = 105 \). To the nearest tenth, what is \( \angle K \)?
Ex 3)
A ship has been at sea longer than expected and has only enough fuel to safely sail another 42 miles. Port City Lighthouse and Cove Town Lighthouse are located 40 miles apart along the coast. At sea, the captain cannot determine distances by observation. The triangle formed by the lighthouses and the ship is shown. Can the ship sail safely to either lighthouse?

you try)
The right-fielder fields a softball between first base and second base as shown in the figure. If the right-fielder throws the ball to second base, how far does she throw the ball?
Exit Ticket 8-5

1. In \( \triangle HPM \), \( m \angle P = 40 \), \( m \angle M = 59 \), and \( HP = 7.5 \). To the nearest tenth, what is the length of \( HM \)?

2. In \( \triangle ART \), \( m \angle A = 77 \), \( AR = 5 \), and \( RT = 9 \). To the nearest tenth, what is the \( m \angle T \)?

3. Two spotlights are placed as shown below to illuminate an art piece. About how far is Lamp 1 from Lamp 2?

![Diagram of two spotlights illuminating an art piece with distances and angles labeled.]