Goal: To solve triangles using the Law of Sines

\[
\tan \theta = \frac{30}{60} = \frac{1}{2}
\]

\[
\theta \approx 26.6^\circ
\]
\[ \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \]

**Notes on congruent \( \Delta \)s**

Congruent by \( \text{ASA} \)

Other congruent properties:
- \( \text{SSS} \)
- \( \text{SAS} \)
- \( \text{SSA} \) ambiguous
- \( \text{AAS} \)

\[ \text{\# solve the triangle (AAS')} \]

\[ A = 135^\circ \]
\[ B = 30^\circ \]
\[ b = 20 \]

\[ \frac{a}{\sin 135^\circ} = \frac{20}{\sin 30^\circ} \]

\[ a = 20 \sin 135^\circ \]
\[ a = \frac{20 \sqrt{2}}{\frac{1}{2}} = 20 \sqrt{2} \cdot 2 = 20 \sqrt{2} \text{ units} \]

\[ C = 180^\circ - 30^\circ - 135^\circ = 15^\circ \]

\[ \frac{c}{\sin 15^\circ} = \frac{20}{\sin 30^\circ} \]

\[ c = \frac{20 \sin 15^\circ}{\sin 30^\circ} \approx 10.35 \text{ units} \]

6) \[ a = 12, \quad b = 31, \quad A = 20.5^\circ \]

\[ \frac{31}{\sin B} = \frac{12}{\sin 20.5^\circ} \]

\[ 12 \sin B = 31 \sin 20.5^\circ \]

\[ \sin B = \frac{31 \sin 20.5^\circ}{12} \approx 0.9 \]

\[ B = \sin^{-1}\left(\frac{31 \sin 20.5^\circ}{12}\right) \]
Direction Specification

**Heading:** The angular direction in which a craft is pointed. Heading is expressed in terms of an angle measured clockwise from the north.

**Bearing:** Used to locate one object in relation to another object. It is expressed in terms of the acute angle formed by a north-south line of direction.

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### Case I

- \( B_2 = 64.8^\circ \)
- \( C = 180^\circ - 64.8^\circ - 20.5^\circ \) or \( B_2 = 115.2^\circ \)
- \( C = 94.7^\circ \)

\[
\frac{c}{\sin 94.7^\circ} = \frac{12}{\sin 20.5^\circ}
\]

\[
c = 12 \times \frac{\sin 94.7^\circ}{\sin 20.5^\circ}
\]

\( \approx 34.2 \text{ units} \)

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### Case II

- \( C_1 = 180^\circ - 115.2^\circ - 20.5^\circ \) or \( C_1 = 44.3^\circ \)
- \( C_2 = 23.9 \text{ units} \)

\[
\frac{c}{\sin 44.3^\circ} = \frac{12}{\sin 20.5^\circ}
\]

\[
c = 12 \times \frac{\sin 44.3^\circ}{\sin 20.5^\circ}
\]

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**Diagram:**

- **Heading** 225°
- **Bearing**

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**Diagram:**

- **Object 1**
- **Object 2**

**Object 2 is S 30° E**
**Distance to a Lighthouse** A navigator on a ship sights a lighthouse at a bearing of N36°E. After traveling 8.0 miles at a heading of 332°, the ship sights the lighthouse at a bearing of S82°E. How far is the ship from the lighthouse at the second sighting?

![Diagram of the navigation scenario](image)

**Use Law of Sines to find a**

\[
\frac{a}{\sin 64°} = \frac{8}{\sin 62°}
\]

\[
a = \frac{8 \sin 64°}{\sin 62°} \\
= 8.1 \text{ miles}
\]
\[
a = \frac{8 \sin 64^\circ}{\sin 62^\circ} \approx 8.1 \text{ miles}
\]