SOH CAH TOA is used for right triangles only. For other triangles we use law of sines and law of cosines.

5.6 Use the **Law of Sines** to solve an oblique triangle

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

or

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

This means a not at a right angle or classified as any special angle.

---

1. a = 12.8, A = 65°, b = 7.7, B = 33°, c = 14, C = 82°

2. a = 58, A = 50°, b = 76, B = 94.5, c = 91.2, C = 33.5

3. a = 40, A = 40°, b = 12, B = 33.5, c = 22.5
Coast Guard. Two lookout posts, A and B (10.0 miles apart), are established along a coast to watch for illegal ships coming within the 3-mile limit. If post A reports a ship S at angle BAS = 37°30' and post B reports the same ship at angle ABS = 20°0', how far is the ship from post A? How far is the ship from the shore (assuming the shore is along the line joining the two observation posts)?

Use the Law of Cosines to solve oblique triangles

An oblique triangle does not have a right angle in it. It could be acute (all three angles less than 90°) or it could be obtuse (one angle greater than 90° and the other two less than 90°).

If you are given the lengths of the sides of a triangle (SSS), or 2 sides and the included angle (SAS), you can use the Law of Cosines to solve the triangle.

**Law of Cosines**

- \( a^2 = b^2 + c^2 - 2bc \cos A \)
- \( b^2 = a^2 + c^2 - 2ac \cos B \)
- \( c^2 = a^2 + b^2 - 2ab \cos C \)

**Examples**

1. Solve the triangle given \( B = 114°, \alpha = 14, c = 8 \).

   \[ b^2 = 14^2 + 8^2 - 2(14)(8) \cos 114° \]
   \[ b = 18.7 \]

   \[ c = 8 \]
   \[ a = 14 \]
   \[ \alpha = 14° \]
   \[ \beta = 114° \]
   \[ \gamma = 52.1° \]

   \[ \beta = 114° \]
   \[ \gamma = 52.1° \]
   \[ A = 43.2° \]
Use the Law of Sines to solve each triangle. Round to tenths. (some have 1 solutions, some have 2 solutions, and some have no solution)

1. A = 30°, a = 8, b = 5
2. A = 135°, a = 4.5, b = 6.8
3. A = 58°, a = 4.5, b = 12.8
4. A = 65°, B = 40°, c = 45.3
5. B = 48.1°, a = 5.24, b = 4.46
6. A = 63°, a = 42, b = 120
7. B = 30°, b = 40, a = 60
8. A = 60°, B = 40°, c = 6
9. A = 48.2°, a = 15, b = 20

21. Surveying: A surveyor wants to find the width of a narrow, deep gorge from a point on the edge. To do this, the surveyor takes measurements as shown in the figure at the right. How wide is the gorge?
Round to tenths

1. \( A = 95^\circ \), \( a = 11.3 \), \( B = 23^\circ \)
2. \( B = 80^\circ \), \( b = 91 \), \( C = 46^\circ \)
3. \( c = 3.1 \), \( c = 9.3 \), \( c = 5.9 \), \( b = 5.2 \)
4. \( A = 64^\circ \), \( b = 113 \), \( c = 13.7 \), \( x \times x = 20 + b \)
5. \( x = 30 \) km, \( y = 30 \) km
6. \( \frac{49}{\sin 97^\circ} = \frac{x}{\sin 37^\circ} \)
7. \( x = 51.8 \) km