Name: _____ Date: _____

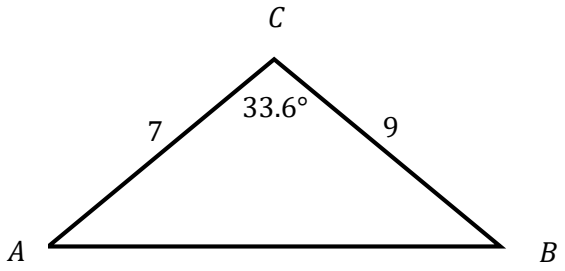
Learning Goal 2.3	Use of sine and cosine laws to solve non-right triangles, including ambiguous cases.

1. Lions Gate Bridge has been a Vancouver landmark since it opened in 1938. It is the longest suspension bridge in Western Canada. The bridge is strengthened by triangular braces. Suppose one brace has side lengths $14\text{ m}, 18\text{ m}$ and 22 m. Determine the measure of the angle opposite the $18-\text{m}$ side to the nearest degree.

$$\begin{aligned} a^2 &= b^2 + c^2 - 2bc\cos A \\ 18^2 &= 14^2 + 22^2 - 2(14)(22)\cos A \\ 324 &= 196 + 484 - 616\cos A \\ -356 &= -616\cos A \\ \cos A &= \frac{356}{616} \\ A &= \cos^{-1}\left(\frac{356}{616}\right) \\ A &\approx 55° \end{aligned}$$

2. In $\Delta ABC, a = 9, b = 7$ and $\measuredangle C = 33.6°$. Sketch a diagram and determine the length of the unknown side and the measures of the unknown angles to the nearest tenth.

$$\begin{aligned} c^2 &= a^2 + b^2 - 2ab\cos C \\ c^2 &= 9^2 + 7^2 - 2(9)(7)\cos(33.6) \\ c^2 &= 81 + 49 - 126\cos(33.6) \\ c^2 &= 130 - 126\cos(33.6) \\ c^2 &= 130 - 104.95 \\ c^2 &= 25.05 \\ c &\approx 5.0 \end{aligned}$$



$$\begin{aligned} \frac{\sin A}{a} &= \frac{\sin C}{c} \\ \frac{\sin A}{9} &= \frac{\sin 33.6}{5.0} \\ \sin A &= 9 \times \frac{\sin 33.6}{5.0} \\ A &= \sin^{-1}\left(9 \times \frac{\sin 33.6}{5.0}\right) \\ A &\approx 84° \end{aligned}$$

$$\begin{aligned} A + B + C &= 180° \\ B &= 180° - A - C \\ B &= 180° - 84° - 33.6° \\ B &\approx 62° \end{aligned}$$

3. Nina wants to find the distance between two points, A and B on opposite sides of a pond. She locates a point C that is 35.5 m from A and 48.8 m from B. If the angle at C is $54°$, determine the distance AB to the nearest tenth of a metre.

$$\begin{aligned} c^2 &= a^2 + b^2 - 2ab\cos C \\ c^2 &= 35.5^2 + 48.8^2 - 2(35.5)(48.8)\cos(54) \\ c^2 &= 1260.25 + 2381.44 - 3464.8\cos(54) \\ c^2 &= 3641.69 - 3464.8\cos(54) \\ c^2 &\approx 3641.69 - 2036.56 \\ c^2 &\approx 1605.13 \\ c &\approx 40.1 \end{aligned}$$

The pond is approximately 40.1 m wide.