Measurement 2.11 – Solving Right Triangles

Today we will:
- Develop and apply primary trigonometric ratios (tangent, sine and cosine) to solve problems that involve right triangles.

*** Is your calculator in degree mode? ***  \( \tan 45 = 1 \)

Looking for a side:

\[
\sin A = \frac{\text{Opp}}{\text{Hyp}} \quad \cos A = \frac{\text{Adj}}{\text{Hyp}} \quad \tan A = \frac{\text{Opp}}{\text{Adj}}
\]

Looking for an angle:

\[
\sin^{-1} \left( \frac{\text{Opp}}{\text{Hyp}} \right) = A \quad \cos^{-1} \left( \frac{\text{Adj}}{\text{Hyp}} \right) = A \quad \tan^{-1} \left( \frac{\text{Opp}}{\text{Adj}} \right) = A
\]

Angle of Elevation:
Angle that opens from the horizontal upwards.

Angle of Depression:
Angle that opens downwards from the horizontal

Solving a Triangle:

** Solve and label every side and every angle of triangle **
**Example:** From a height of 50m in his fire tower a ranger observes the beginnings of two fires. One fire is due west at an angle of depression of 9°. The other fire is due east at an angle of depression of 7°. What is the distance between the two fires to the nearest meter?

\[
\begin{align*}
\text{SOH CAH TOA} \\
\tan A = \frac{\text{opp}}{\text{adj}} \\
(50)\tan(9°) = x \\
x = 316m
\end{align*}
\]

**Example:** Calculate the length of BC, to the nearest tenth of a centimeter.

\[
\begin{align*}
\tan A = \frac{\text{opp}}{\text{adj}} \\
(10)\tan(40°) = x \\
x = 8.4cm
\end{align*}
\]

\[
\begin{align*}
\tan C = \frac{\text{opp}}{\text{adj}} \\
\frac{8}{x} = x(\tan 20°) \\
x = 9.5cm
\end{align*}
\]
**Example:** Cell phone towers are used to transmit information from your cell phone to the cell phones of your friends. When you move around you may move in and out of the ranges of certain cell phone towers and more than one cell phone tower may pick up the signal from your cellphone at a time. A cell phone signal was detected 5 mi from tower 1.

![ Triangle Diagram](Image)

a) What is the distance from the caller to tower 3?

\[ \sin A = \frac{\text{opp}}{\text{hyp}} \]

\[ \sin 62 = \frac{y}{7} \]

\[ y = 6.2 \text{ mi} \]

b) How far is tower 1 from tower 3?

\[ a^2 + b^2 = c^2 \]

\[ 5^2 + 6.2^2 = c^2 \]

\[ c = 8 \text{ mi} \]

**Example:** Determine the values of \(x\) and \(y\) to the nearest tenth of a centimeter.

![ Triangle Diagram](Image)

\[ \tan 58 = \frac{y}{7.8} \]

\[ y = 12.5 \]

\[ \tan 61 = \frac{12.5}{x} \]

\[ x = 6.9 \text{ cm} \]