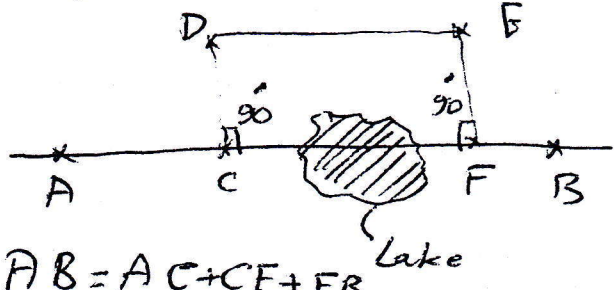
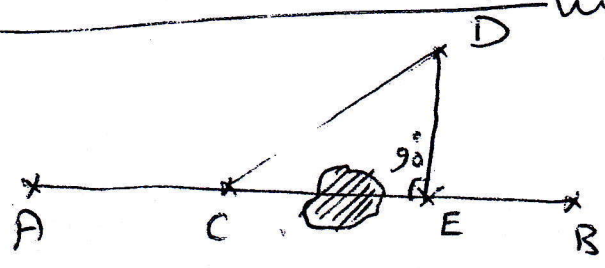


Obstacles during the measurement

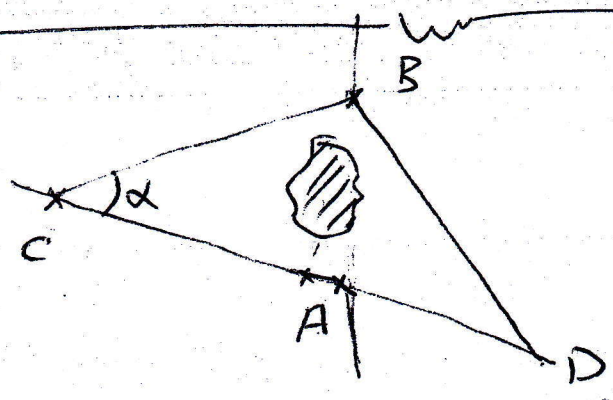
The obstacles are generally large water bodies, i.e. lakes, rivers, etc.



$AB = AC + CF + FB$
 where $CF = DE$

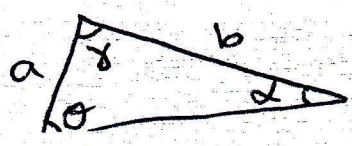


$CE = \sqrt{(CD)^2 - (DE)^2}$
 $AB = AC + CE + EB$



ΔBCD
 $BD^2 = BC^2 + CD^2 - 2BC \cdot CD \cos \alpha$
 $\cos \alpha = \frac{BC^2 + CD^2 - BD^2}{2BC \cdot CD}$

ΔACB $AB^2 = BC^2 + AC^2 - 2BC \cdot AC \cos \alpha$



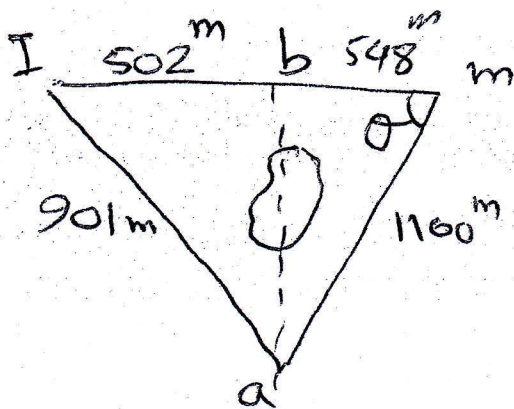
$\frac{a}{\sin \alpha} = \frac{b}{\sin \theta} = \frac{c}{\sin \gamma}$

(11)

example:

A big pond obstructs the chain line (ab). A line (aI) was measured on the left of line (ab) for circumventing the obstruct. The length (aI) was 901 m. Similarly, on the right line am was measured on the right of line (ab) whose length was 1100 m. Points m, b, and I are on the same straight line. Lengths of lines (bI) and (bm) are 502 m and 548 m, respectively. Find the distance (ab).

Sol:



$$\Delta amI$$

$$\cos \theta = \frac{am^2 + mI^2 - aI^2}{2am \cdot mI}$$

$$\cos \theta = \frac{(1100)^2 + (1050)^2 - (901)^2}{2 \cdot 1100 \cdot 1050}$$

$$= 0.6496532$$

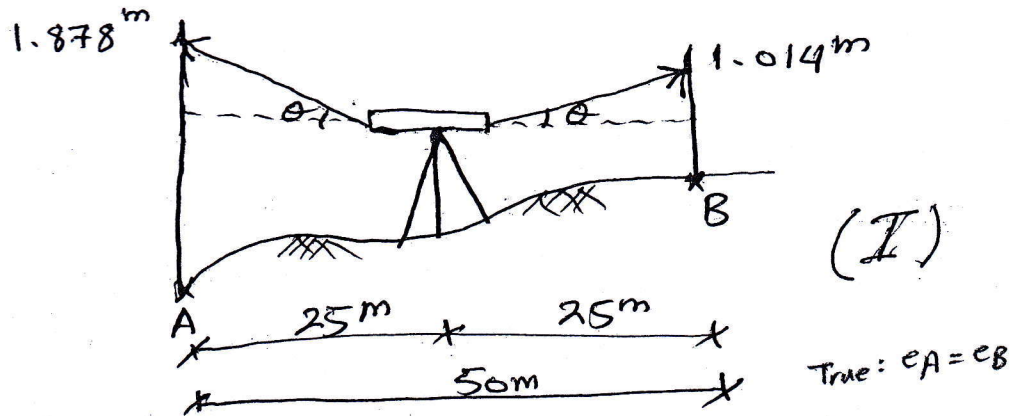
$$ab^2 = am^2 + bm^2 - 2am \cdot bm \cdot \cos \theta$$

$$= 1100^2 + 548^2 - 2 \cdot 1100 \cdot 548 \cdot 0.6496532$$

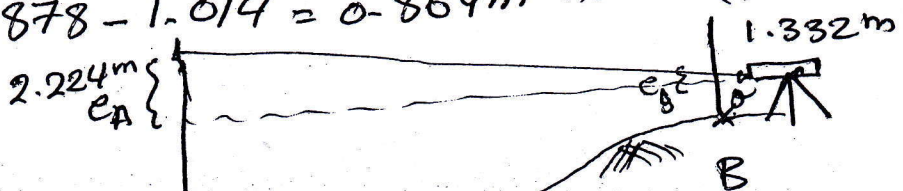
$$ab = \sqrt{727146.24} = 852.69 \text{ m.}$$

①

Permanent adjustment of level device readings (Two Pegs method)



I) $\Delta H)_{AB}^{True} = 1.878 - 1.014 = 0.864m \dots (1)$



II) $\Delta H)_{AB} = 2.224 - 1.332 = 0.892m \dots (2)$

$\Delta H)_{II} > \Delta H)_{I} \Rightarrow$ The line of sight upward (+ve)

Correct reading at A = $2.224 - e_A$

Correct reading at B = $1.332 - e_B$

where: $e_A = 60 \tan \theta$ and $e_B = 10 \tan \theta$

$\Delta H)_{AB}^{True} = (\text{Correct reading at A}) - (\text{Correct reading at B})$

$0.864 = (2.224 - 60 \tan \theta) - (1.332 - 10 \tan \theta) \dots (3)$

may be (+ve)
when the line of sight downward

Solved Eq. (3) to find $(\tan \theta)$ and e_A, e_B to find correct reading at A and B.

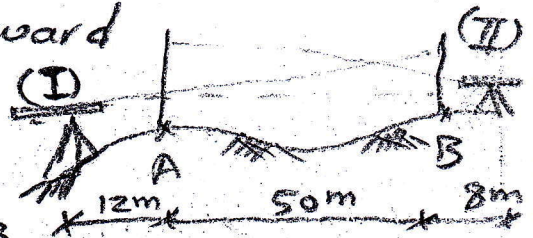
H.W

(2)

Example / After the temporary adjusting the leveling device, the readings of staffs at position A and B were 2.481^m and 1.693^m , respectively, where the leveling device puts at $12m$ behind the position A and the distance between A and B was $50m$. After transferring the leveling device behind B at a distance $8m$ and the temporary adjusting on the leveling device was established again, the readings of staff at A and B were 2.051^m and 1.281^m , respectively. Find the correct readings at A and B if there is an error in the leveling readings.

Sol. assume the line of sight upward

I) $\left\{ \begin{array}{l} \text{Correct reading)}_A = 2.481 - 12 \tan \theta \dots \text{--- (A)} \\ \text{Correct reading)}_B = 1.693 - 62 \tan \theta \dots \text{--- (B)} \\ \Delta H)_{AB} = \text{Correct reading)}_A - \text{Correct reading)}_B \\ \Delta H)_{AB} = 0.788 + 50 \tan \theta \dots \text{--- (1)} \end{array} \right.$



II) $\left\{ \begin{array}{l} \text{Correct reading)}_A = 2.051 - 58 \tan \theta \dots \text{--- (C)} \\ \text{Correct reading)}_B = 1.281 - 8 \tan \theta \dots \text{--- (D)} \\ \Delta H)_{AB} = \text{Correct reading)}_A - \text{Correct reading)}_B \\ \Delta H)_{II} AB = 0.77 - 50 \tan \theta \dots \text{--- (2)} \end{array} \right.$

By combination between Eq. (1) and Eq. (2)

$$\Delta H)_{AB} = 0.779 \dots \text{--- (3)}$$

Substituting Eq. (3) in Eq. (1) OR substituting Eq. (3) in Eq. (2)

$$\tan \theta = -0.00618$$

$$\left. \begin{array}{l} \text{Then Correct reading)}_A = 2.483^m \\ \text{Correct reading)}_B = 1.704^m \end{array} \right\} \text{I}$$

$$\text{Correct reading)}_A = 2.061^m \quad \text{? II}$$